Vol. 97, No. 11 NOVEMBER, 1950

WATER & SEWAGE WORKS

WATER SUPPLY

SEWAGE DISPOSAL

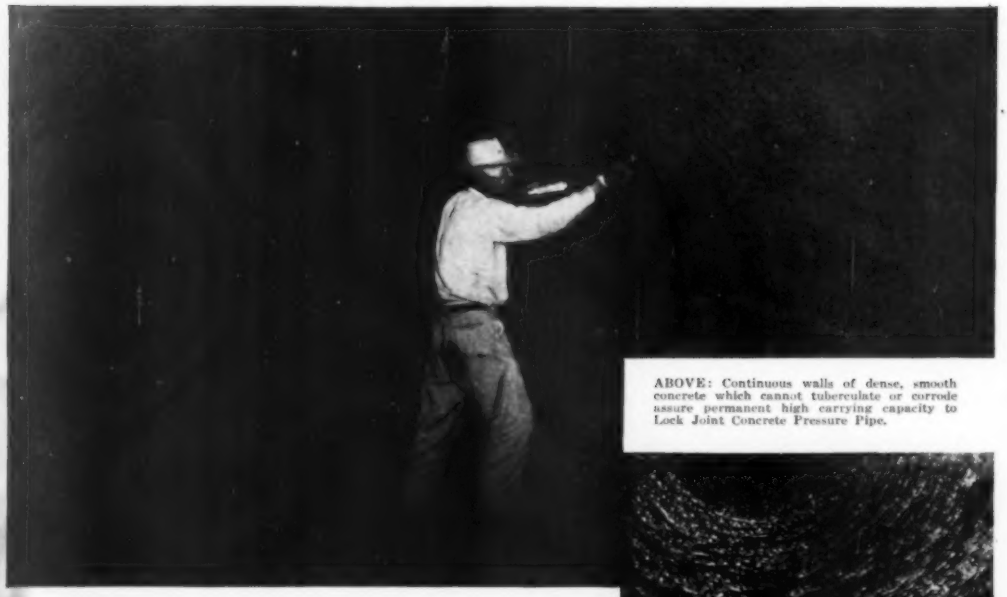
INDUSTRIAL WASTE TREATMENT

THE "FLOSSIE BELL"

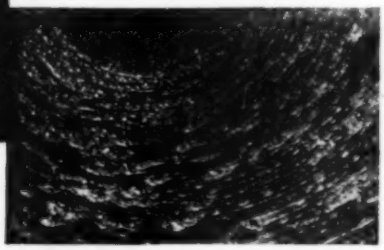
PIGS FOR PIPE

[Story in this Issue]

CONCRETE *is the answer to your main problem*



ABOVE: Continuous walls of dense, smooth concrete which cannot tuberculate or corrode assure permanent high carrying capacity to Lock Joint Concrete Pressure Pipe.



ABOVE: The tuberculated condition of this metallic pipe line reduces its carrying capacity by 50%.

Tuberculated mains—corroded mains—leaky mains—all cost municipalities, taxpayers and industry immense sums every year in added pumping costs, maintenance and repairs. Yet, by the use of Lock Joint Concrete Pressure Pipe, all of this unnecessary expense could be eliminated.

1. LOCK JOINT PRESSURE PIPE
does not tuberculate . . .

RESULT
- No excessive pumping costs
- No periodic cleaning costs
- No loss of income from inadequate delivery of water to the consumer

2. LOCK JOINT PRESSURE PIPE
does not pit or perforate from electrolysis or corrosion

RESULT
- No cost for major repairs
- No cost for periodic patchwork
- No loss of revenue while the line is shut down for emergency repairs.

Consider these facts when you plan your next water supply or transmission main and specify Lock Joint—the pressure pipe of perpetual economy.

Lock Joint Pipe Company for over forty years has specialized exclusively in the manufacture of reinforced concrete pipe for water supply and transmission mains as well as for sewers, culverts and subaqueous installations.

LOCK JOINT PIPE COMPANY

Est. 1905

P.O. Box 269, East Orange, N. J.

PRESSURE PIPE PLANTS: Wharton, N. J., Turner, Kan., Detroit, Mich.

BRANCH OFFICES: Casper, Wyo. • Cheyenne, Wyo. • Denver, Col. Kansas City, Mo. • Valley Park, Mo. • Chicago, Ill. • Rock Island, Ill. Wichita, Kan. • Kenilworth, N. J. • Hartford, Conn. • Tucumcari, N. Mex. Oklahoma City, Okla. • Tulsa, Okla.

WATER AND SEWAGE WORKS. Reg. U. S. Patent Off. November, 1950. Volume 97. Number 11. Published monthly by Gillette Publishing Co., at 404 North Wesley Ave., Mount Morris, Ill. Per copy, 25c: Subscription rate: United States, $2.00 per year; Canada, $2.00 per year; Foreign, $3.00 per year. Entered as second class matter March 4, 1948, at the post office at Mount Morris, Illinois, under Act of March 3, 1879. Executive and business offices, 22 W. Maple St., Chicago 10, Illinois. Editorial office, 155 E. 44th St., New York 17, N.Y.

ARE YOU GETTING ALL THE REVENUE FROM LARGE CONSUMERS?

Rockwell fits the Meter to the Service for Greatest Yield!

Your meters on industrial, commercial and apartment house lines should be big money earners. To get all the revenue from these services you need the right type of meter on the job. Fitting the proper meter to the setting is an important part of Rockwell service. *Ours is the only complete line.* No matter what your requirement there's a Rockwell meter that will do the job better because it has been custom tailored to the service. Now is the time to get *all* the facts on how to collect *all* the revenue. Write today.

THE ONLY COMPLETE LINE OF WATER METERS

Rockwell

MANUFACTURING COMPANY

PITTSBURGH 8, PA. • Atlanta • Boston • Chicago
Columbus • Houston • Kansas City • Los Angeles
New York • Pittsburgh • San Francisco • Seattle • Tulsa

water tanks

chlorinator breakdown

power failure

CHECKMATE all these Sanitation Problems With...

new water mains

broken mains

Whether your problem is one of emergency or routine sanitation, you can depend on Sanitation HTH for a successful performance every time. This dry, granular, free-flowing product is easy to use and store, and always provides a minimum of 70% available chlorine. Be ready at all times for the next move—keep plenty of HTH available. Mathieson Chemical Corporation, Mathieson Building, Baltimore 3, Maryland.

Sanitation HTH is available in cases of nine handy 5-lb. cans and in 100-lb. drums

Mathieson CHEMICALS

SERVING INDUSTRY, AGRICULTURE & PUBLIC HEALTH

WATER & SEWAGE WORKS

WATER SUPPLY—SEWAGE DISPOSAL—INDUSTRIAL WASTE TREATMENT

E. S. GILLETTE, Publisher

L. H. ENSLOW, Editor*

COMING!

Centrifugal Pumps and Their Operation

Nothing in water works operation counts for as much dollar-wise as does pumping. Naturally, of first importance is that of selecting the correct pump for the conditions under which it is to be installed and operated. After that, one can never know too much about the methods of checking pump performance and the maintenance of pumping efficiency. We are, therefore, pleased to announce the early beginning of a series of articles on "Basic Factors in Centrifugal Pump Application," and related considerations in centrifugal pumping of water and sewage by—

ROY CARTER and I. J. KARASSIK,
Application Engineers, Worthington Pumps.

"Headaches, Hunches & Hard Work"

Is the title of a running series of short stories, each constituting a few pages from the life, the philosophy, and the experiences of a self-made water superintendent, who has had more than one man's share of varied experiences. These articles are both instructive, and entertaining—don't miss any of the series. The story teller is that "half-pint, do-or-die" ex water sup't and Honorary Member A.W.W.A.

M'KEAN MAFFITT,
Former Supt., Wilmington, N. C.

Sewage Treatment Equipment

Is the subject of a valuable series of articles, now running, on the design, installation, operation and maintenance of equipment in sewage treatment plants. Each article is to deal with some unit operation of modern sewage plants, and will present information of value to designers, operators, and also manufacturers of such equipment. Articles to follow cover "Sludge Digesters"; "Vacuum Filtration of Sludge"; "Drying and Incineration"; "Trickling Filter Distributors"; "Aeration Equipment"; "Gas Storage and Utilization," and others. The author is—

FRANK L. FLOOD,
Metcalf & Eddy Engrs., Boston, Mass.

A New and Different Trenching Machine

When a superintendent, not satisfied with available construction equipment, and who knows what is needed for water and sewer trenching, goes to a manufacturer and gets the piece of equipment built to fulfill his requirements, such a development is news-worthy. Just that was done up in Ware, Mass. and Jim Reilly, Sup't. at Ware, tells about the new "Ware Hydro-Trencher" and what it will do. From what can be learned through hearsay and opinions of water works men this new trencher will be well worth reading about.

Determining Organic Nitrogen in Water & Sewage

Is rendered simpler and more accurate by the use of apparatus and procedure described by—

DON B. WILLIAMS, Chemist
Brantford, Ontario, Water Works

Experiences in Operating Small Water Works

Two articles are scheduled which will relate operating experiences at small water plants. The authors are Frank Gosnell, Sup't. at Laurel, Md. and John Kapp, Sup't. at Haledon, N. J.

The Equilibrium Percolation Test for the Design of Sewage Leaching Fields

Has received further study by its originator. Confirmatory tests are now reported by—

LUDWIG, WARD, O'LEARY & PEARL,
University of California.

Anti-Corrosion Treatment and Break-Point Chlorination

Constituted the principal problems in a pilot-plant study at Maynard, Mass., in which the control of iron bacteria in the distribution system was a major consideration. The results of a combination of aeration, lime-soda treatment and break-point chlorination are told by the chemist in charge of the studies—

WERNER N. GRUNE, Project Director,
New York Univ., New York.

Managing Editor
GEORGE E. SYMONS, PH.D.

Assistant Editor
F. C. MAURER

Editorial Associates
J. R. BAYLIS
A. M. RAWN
H. A. FABER

Adv. Editor
H. J. CONWAY

Make-Up Editor
W. W. VANSTONE

*MEMBER

VOL. 97, No. 11 — CONTENTS — NOVEMBER, 1950

Charges for Private Fire Protection Service 441
By Richard H. Ellis, Boston, Massachusetts

London's Water Supply 446
By E. S. Boniface, London, England

NEWWA 69th Annual Convention 447

Operation of Small Water Works 454
By A. E. Clark, Nashville, Tennessee

Are We Ready for High-Rate Filtration of Water 456
By John R. Baylis, Chicago, Illinois

The Supervisor's Stake in Safety 459
By Harold F. Webb, New York, New York

A New Cast-Iron Pipe Plant Is Born 462
By L. D. Webster, Dallas, Texas

Sewer Maintenance and Cleaning Practices 464
By John W. Hood, Ridgewood, New Jersey

Addition of Garbage to Sewage 467
By T. R. Haseltine, Pittsburgh, Pennsylvania

Milk Waste Treatment on an Experimental Trickling Filter 473
By Earnest F. Gloyna, Austin, Texas

Economics of Waste Treatment 479
By V. J. Calise, New York, New York

Editorial 484

"Here and There" with Doc Symons 86A

Manufacturers' and Equipment Items 92A

Literature and Catalog Reviews 103A

Water & Sewage Works is indexed regularly by Engineering Index, Inc.

Publication Office, 404 N. Wesley Ave., Mt. Morris, Ill.
(Address communications to the Executive Office or the Editorial Office)

EXECUTIVE OFFICE
22 W. Maple St., Chicago 10, Ill.

EDITORIAL OFFICE
155 E. 44th St., New York 17, N. Y.

H. P. GILLETTE, Pres.; E. S. GILLETTE, Vice Pres.; L. H. ENSLOW, Vice Pres.

New York Office ..... H. D. Crippen, Mgr.
155 E. 44th St. ..... F. A. Michel, Rep.

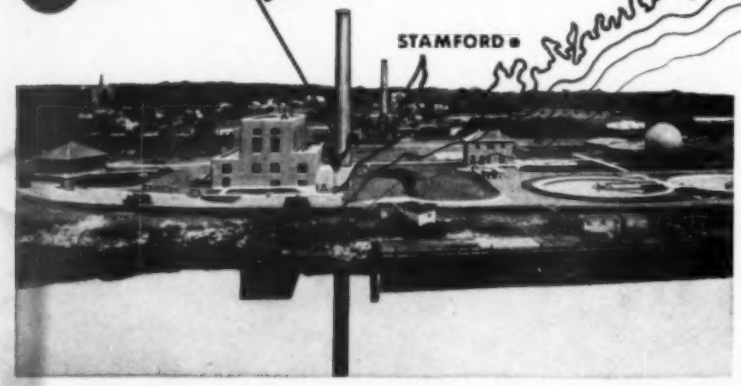
Chicago Office ..... M. B. Nylund, Rep., R. T. Wilson, Rep.
22 W. Maple St.

Cleveland Office ..... Lee B. McMahon, Mgr.
Leader Bldg. ..... Wm. P. Saunders, Rep.

Pasadena Office ..... John A. Osborne, Rep.
1126 Del Rey

WATER AND SEWAGE WORKS is a monthly publication. Single Copies, 25c; Subscription Rates, U. S. and Canada, $2 per year; Foreign, $3.
(Member—Audit Bureau of Circulation and Associated Business Papers.)

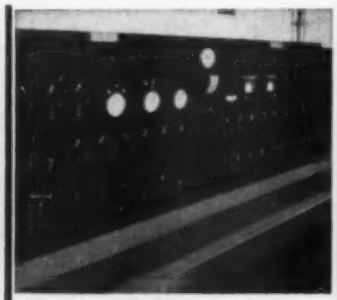
Stamford invests in



Sewage treatment and incineration are combined into one operating unit at Stamford, Conn. The plant uses the elutriation process to condition sludge. The effluent is post-chlorinated and sludge is flash dried for sale as a soil conditioner.

General Electric motors and control used throughout the plant keep running expenses low.

At this outdoor G-E unit substation, high voltage is dropped to utilization voltage for distribution to G-E motors and control throughout the plant. G-E standardized unit substations are completely factory-assembled, ready-to-install units.



One of the nerve centers of the Stamford plant, this G-E Cabinetrol control installation centralizes low-voltage control of motors, lighting, and other auxiliary equipment. Such installations conserve space and save steps; make for more efficient operation.

These G-E vertical motors drive centrifugal pumps which pick up sewage after it passes through bar screens. The control above the first motor automatically selects the pump or pumps needed to handle the flow. Five motors—one 20-hp, one 40-hp, and three 75-hp—are used.

GENERAL ELECTRIC

666-57

CLEAN WATERS

Modern G-E Equipped Combination Wastes Plant Economically Serves City of 70,000

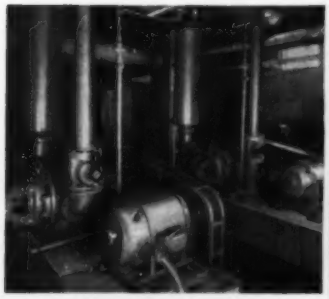
Before 1944, most of Stamford Connecticut's sewage had to run through its treatment plant quickly or by-pass it entirely. This created an unhealthful condition in Stamford Harbor and Long Island Sound. Today, *Stamford's waters are clean.*

Finding itself in the same situation as many other cities where the war brought increases in industrial activity and population, Stamford solved its sanitation problem by rebuilding its sewage treatment and incineration plants to combine them into one operating unit.

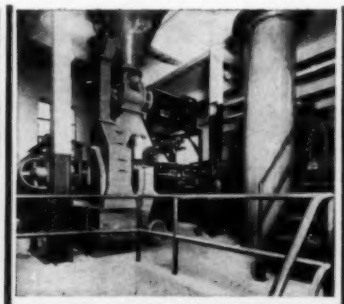
This investment in *clean waters* is returning large dividends in the form of better health, cleaner beaches, and higher community standing. What's more: the plant operator says the power cost of the new plant is less than the old one, thanks to modern processes and equipment recommended by the consulting engineer and General Electric.

General Electric can help your community get that new or improved sewage treatment plant by giving engineering assistance to help you and your consultant —*first* in helping formulate electrical plans and *second* in building public support with the full-color sound movie *Clean Waters*.

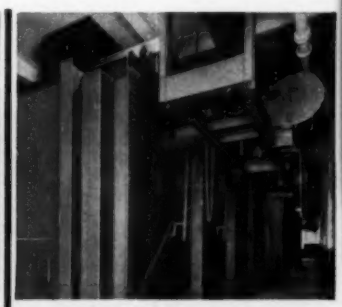
Contact your General Electric office early in the planning stage. The nearest G-E office is listed in your local classified 'phone directory. *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*



The Tri-Clad motors shown above are V-belted to vacuum pumps used in the sludge dewatering process. Sludge is pumped from the elutriation tanks into vacuum filters for de-watering. Motors are 15 hp, 1800 rpm, and operate on 208-volts, 3-phase, 60-cycle a-c.



From the vacuum filter, sludge is conveyed from the sludge drying and weighing equipment. Drying and weighing equipment is at left, a dry divider at right rear. View shows one of several G-E motors used throughout the process.



Dry sludge is driven by means of screw feeders into garbage and refuse incinerators when required; normally, however, it is bagged and sold. Tri-Clad® special-purpose, open, gear-motors, mounted on the frame at upper right, chain-drive the conveyors.

GE SEWAGE-PLANT

Bulletin on POROUS MEDIA by CARBORUNDUM

TRADE MARK

Bulletin No. 11 NOVEMBER, 1950

Air Diffusion Also Proves Versatile Tool for Treatment of Industrial Wastes

Aeration—well recognized as an effective means of treating sewage—is also equally effective in treating almost any type of industrial waste. It is extremely versatile and can be used in one or more of the processing steps.

Whatever the objective—whether it is for "sweeping," flocculation, solids classification, or purely for oxygenation—aeration has many advantages. (Even a combination of such objectives is very practical and can be economically accomplished in the same or adjacent units.)

The most efficient aeration is done by means of the air diffusion method. And by far the best medium for air diffusion is a porous ceramic diffuser. This combination makes it possible to accurately control a uniform diffusion of small air bubbles—hence assuring optimum results in any given process.

Ceramic diffusers, such as ALOXITE aluminum oxide plates and tubes, have proved their superior efficiency through many years of use. They are rugged, uniform, chemically stable and, when operated normally, will retain their original permeability for years.

Properties of ALOXITE Porous Media

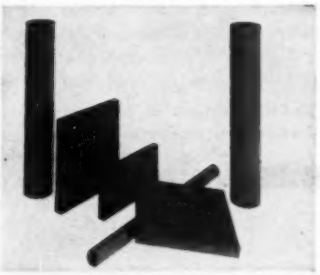
MATERIAL	Ceramically bonded crystalline aluminum oxide grain of controlled sizes.
GRADES (Pore Size)	Filter Underdrains ... coarse and very coarse. Direct Filtration ... range from very fine to medium. Diatomite Support ... range from fine to medium. Air (gas) Diffusion ... range from fine to coarse (permeability from 10 to 120).
SOLUBILITY	In Water and Air ... Insoluble at all normal operating temperatures. In Acids ... generally resistant at all operating temperatures, except to hydrofluoric acid. In Alkaline Solutions ... ceramic bonds are progressively soluble with time and temperature increases.
STRENGTH	Transverse breaking strength is relatively good ranging from 1000 lbs./sq. in. (coarse grades) to 3000 lbs./sq. in. (fine grades).
REFRACTORINESS	All grades withstand up to 900° C. without softening.
THERMAL SHOCK RESISTANCE	Withstand changes up to 20° C./hr. (Where more severe heat shock exists, ceramically bonded silicon carbide porous media are available.)
POROSITY	Ratio of pore volume to total volume of all grades approximately 35%.
WEIGHT	Approximately 0.09 lbs./cu. in.

"Carborundum" and "Aloxite" are registered trademarks which indicate manufacture by The Carborundum Company

POROUS DIFFUSER BUBBLES

Q Among the successful applications for ALOXITE diffusers in sewage and industrial waste treatment are the following:

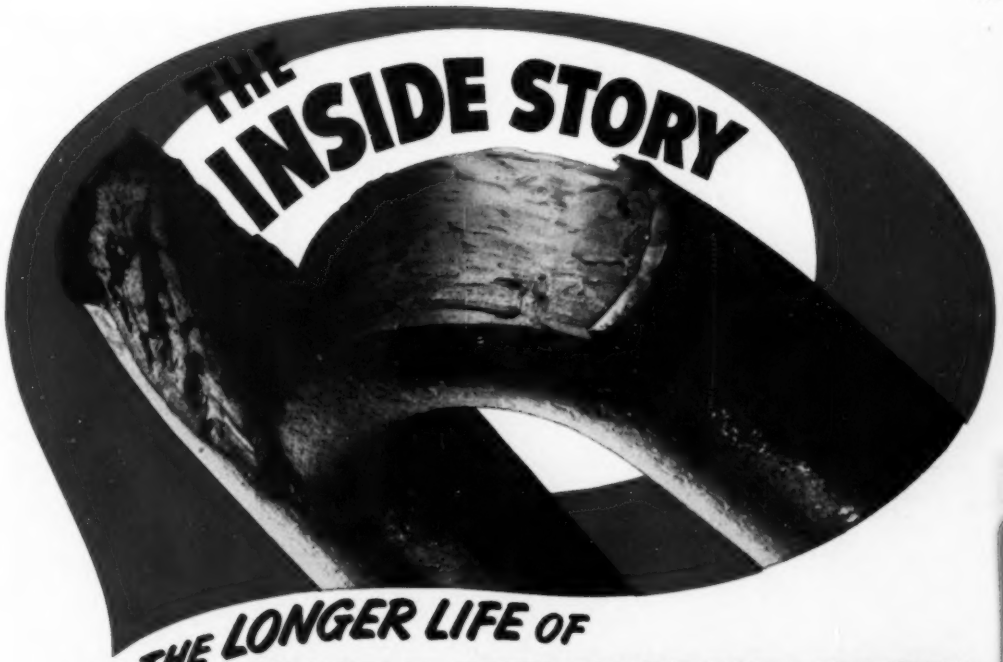
Grit Separation Tanks
Pre-Aeration—Grease Separation
Pre-Aeration—Solids Flocculation
Channel Aeration—Solids Suspension & Distribution
Plain Aeration
Step Aeration
Tapered Aeration
Standard Activated Sludge
Trickling Filter Pre-Aeration
Trickling Filter Post-Aeration
Digestor Sludge and Liquor Nitrification
Oxygenation of De-Inking Wastes
Oxygenation of Tannery Waste
Wool Scouring Waste—Degreasing
Wool Scouring Waste—Oxygenation
Oxygenation of Bleachery Waste



LATEST POROUS MEDIA DATA

Technicians in all fields of filtration and diffusion will find this new bulletin the most complete reference source available. Its 56 pages include many charts, tables and photographs. It covers applications, design, specifications, installation and operation. No obligation, of course.

Dept. M-110
THE CARBORUNDUM COMPANY
Refractories Division
PERTH AMBOY, NEW JERSEY

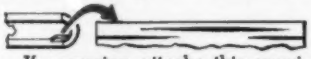


OF THE LONGER LIFE OF BYERS WROUGHT IRON

Every engineer will recognize this picture as a notch-fracture test specimen . . . and will appreciate the unusual physical properties suggested by the break.

The hickory-like fracture results from the unique structure of wrought iron. Tiny threads of glass-like silicate slag, 200,000 to 250,000 per square inch of section, are distributed through a matrix of high-purity iron. This fibrous structure, which might be compared to that of a stranded wire cable, equips wrought iron to withstand sudden shock, and to resist fatigue induced by continuing vibration.

Of even more importance in the average application is the *corrosion resistance* of wrought iron . . . which also comes directly from the unique structure and composition of the material. If a small section of wrought iron were placed under a microscope, a few of the multitude of silicate slag fibers would show up as in this sketch.



If corrosion attacks this specimen, it would first cover the entire surface . . . then concentrate at one point, and work inward. Soon it would encounter one of the slag fibers . . . and since this fiber is unaffected by corrosion, the inward march would be halted. This action is shown by this sketch.

Corrosion is now "detoured." It works right and left, until it comes to the end of the fiber, when it may start to work inward again. The process is repeated when the second line of defense is encountered. Pitting, and rapid penetration of the metal, is discouraged. Useful life is determined by how long it takes for corrosion to reduce the entire body of metal to its safe limit of thickness, rather than by how long it takes corrosion to perforate the wall at a few vulnerable points. The fibers also anchor the initial protective scale, which shields the underlying metal.

Every cost sheet today confirms the fact that the most expensive material you can use is that which must be replaced too soon—and too often. The extra service of wrought iron is helping tens of thousands of users to cut maintenance costs. We will welcome an opportunity to review your piping problem with you—and to recommend the places where wrought iron—on the basis of its past performance—can be profitably used. Ask for our booklet, "THE A B C'S OF WROUGHT IRON."

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, Salt Lake City, San Francisco. Export Division: New York, N. Y.

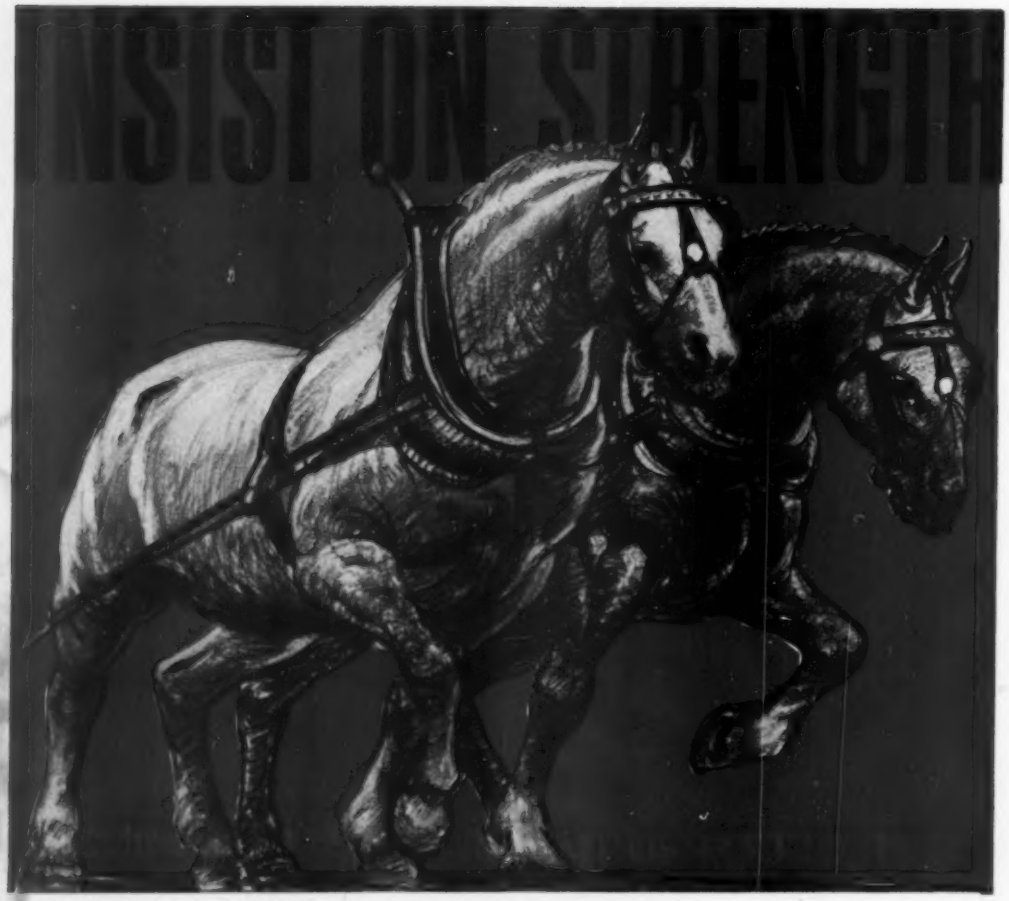
BYERS

CORROSION COSTS YOU MORE THAN WROUGHT IRON

WROUGHT IRON

TUBULAR AND HOT ROLLED PRODUCTS

ELECTRIC FURNACE QUALITY ALLOY AND STAINLESS STEEL PRODUCTS



Like a Percheron draft horse cast iron pipe is known for strength

Long life and low maintenance cost of mains laid under city streets depend not only on effective resistance to corrosion but on definite strength factors. The four strength factors that pipe must have to withstand beam stress, external loads, traffic shocks and severe working pressures, are listed on the page opposite. No pipe that is deficient in any of these strength factors should ever be laid in paved streets of cities, towns or villages. Cast iron water and gas mains, laid over a century ago, are serving in the streets of more than 30 cities in the United States and Canada. Such service records prove that cast iron pipe not only resists corrosion but combines all the strength factors of long life with ample margins of safety.

CAST IRON PIPE

in pipe for city streets

No pipe that is deficient in any of the following strength factors should ever be laid under paved streets.

CRUSHING STRENGTH

The ability of cast iron pipe to withstand external loads imposed by heavy fill and unusual traffic loads is proved by the Ring Compression Test. Standard 6-inch cast iron pipe withstands a crushing weight of more than 14,000 lbs. per foot.

BEAM STRENGTH

When cast iron pipe is subjected to beam stress caused by soil settlement, or disturbance of soil by other utilities, or resting on an obstruction, tests prove that standard 6-inch cast iron pipe in 10-foot span sustains a load of 15,000 lbs.

SHOCK STRENGTH

The toughness of cast iron pipe which enables it to withstand impact and traffic shocks, as well as the hazards in handling, is demonstrated by the Impact Test. While under hydrostatic pressure and the heavy blows from a 50 pound hammer, standard 6-inch cast iron pipe does not crack until the hammer is dropped 6 times *on the same spot* from progressively increased heights of 6 inches.

BURSTING STRENGTH

In full length bursting tests standard 6-inch cast iron pipe withstands more than 2500 lbs. per square inch internal hydrostatic pressure, which proves ample ability to resist water-hammer or unusual working pressures.

CAST IRON PIPE RESEARCH ASSOCIATION, THOS. F. WOLFE, MANAGING DIRECTOR, 122 SO. MICHIGAN AVE., CHICAGO 3.

SERVES FOR CENTURIES

"Look, Bill, what the boss just gave me!"

BILL: *What d'ya mean, the boss gave you? The boss never gave anybody one of his favorite cigars.*

BOB: *It's this way. I happen to walk into the boss's office about something and there he is, pounding the desk at Joe because all the electrical conduit in the pump galleries has got to be replaced. Seems it's the second time in two years they've had to do it.*

BILL: *Well! What's he expect? Corrosion would lick anything in those galleries in two years.*

BOB: *That's what Joe said.*

BILL: *And what's all that got to do with that cigar?*

BOB: *Because just then I said why didn't they use conduit made of Everdur. Seems the Everdur we used for all our valve stems has been in so long they'd completely forgotten all about it.*

BILL: *Hmm. I see. Matter of fact, I'm surprised the boss didn't give you two cigars.*

Wherever corrosion is a problem, that's the place to consider EVERDUR*, as sewage and waterworks engineers everywhere can tell you.

This group of ANACONDA Copper-Silicon Alloys has long been foremost among corrosion-resisting metals – both for performance and for ease of fabrication. Everdur is available in all wrought commercial shapes and in casting ingots. It is readily welded.

If you need a tough, corrosion-resistant metal, let us show you how EVERDUR can help. The American Brass Company, Waterbury 20, Connecticut. In Canada, Anaconda American Brass Ltd., New Toronto, Ont.

*Reg. U. S. Pat. Off.

Where corrosion resistance counts — consider Everdur

ANACONDA®
Copper-Silicon Alloys

THIS HORTON TANK .... reduces pressure variations 60 per cent

La Grange Park, Illinois, recently installed a 250,000-gallon Horton elevated tank to better serve some 8,000 residents.

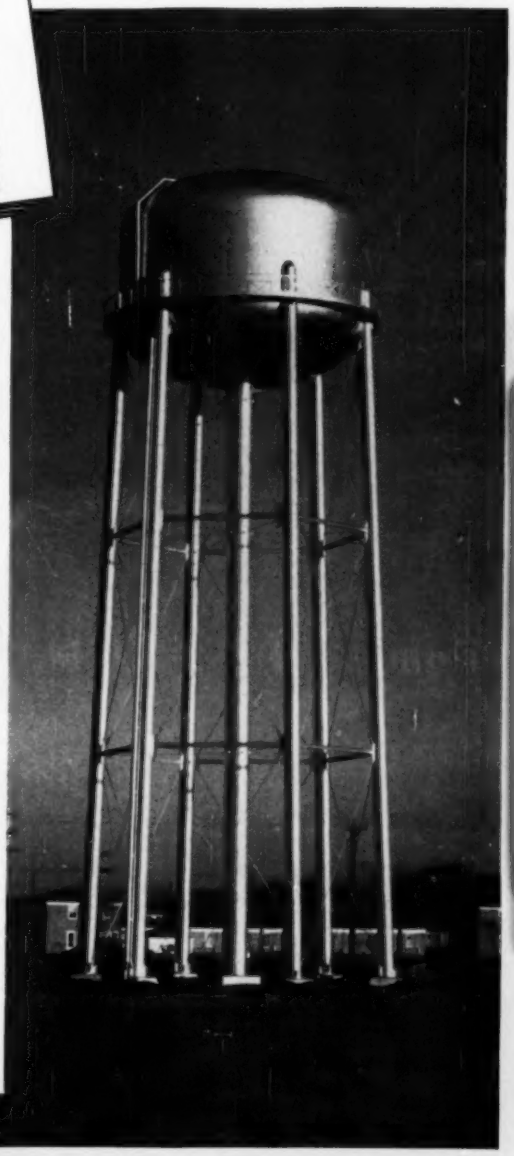
A serious situation prompted this move. At times customers were only able to secure a trickle of water because of the low pressure in the city mains. The maximum pressure was only 30 lbs. per sq. in. and during peak load periods it often slipped to 10 lbs. per sq. in. This 20 lb. pressure variation wasn't only an inconvenience, but it also created a dangerous situation should a fire break out in the city.

Now it's a different story. Since this new Horton tank was installed, pressure variations have decreased to 6½ lbs. . . . a reduction of over 60% . . . and even the minimum water pressure in the city mains is 47 lbs.

Similar satisfying results have been felt by the thousands of municipalities that use Horton elevated water storage.

These tanks are built in a complete range of standard capacities . . . from 15,000 to 500,000 gallons with ellipsoidal bottoms, and from 500,000 to 3,000,000 gallons with radial-cone bottoms. The latter design is desirable for larger capacities because it reduces the range in head.

Full particulars may be had by simply writing our nearest office. There is no obligation.



CHICAGO BRIDGE & IRON COMPANY

Atlanta 3 ..... 2181 Healey Building
Birmingham 1 ..... 1586 North Fiftieth Street
Boston 10 ..... 1048—201 Devonshire Street
Chicago 4 ..... 2198 McCormick Building
Cleveland 15 ..... 2262 Guildhall Building
Detroit 26 ..... 1551 Lafayette Building
Houston 2 ..... 2115 National Standard Building
Havana ..... 402 Abreu Building
Los Angeles 17 ..... 1555 General Petroleum Building
New York 6 ..... 3390—165 Broadway Building
Philadelphia 3 ..... 1646—1700 Walnut Street Building
Salt Lake City 4 ..... 550 West 17th South Street
San Francisco 4 ..... 1583—200 Bush Street
Seattle 1 ..... 1350 Henry Building
Tulsa 3 ..... 1646 Hunt Building

Plants in Birmingham, Chicago, Salt Lake City, and Greenville, Pa.

In Canada—Horton Steel Works, Limited, Fort Erie, Ont.

OPERATES WITH EASE

Cylindrical Plug Valve

Quick turning is an outstanding advantage of a.c.f. design. No wedging in its seat. The precision-machined Cylindrical Plug, pressure lubricated on all seating surfaces is always free to turn. It could be critically important in your plant. Reason enough to give a.c.f. Lubricated Plug Valves preference.

a.c.f. CYLINDRICAL FULL PIPE AREA LUBRICATED **PLUG VALVES**

Representatives in more than 50 Principal Cities.

Ask for catalog 4-WS American Car and Foundry Company, Valve Division, 1501 Ferry Ave., East, Detroit, Mich.

MOBILE, ALABAMA

Eslava Creek Sewage Disposal Plant

(COMPLETED IN 1949)

J. B. CONVERSE & CO., INC.
Consulting Engineers
MOBILE, ALABAMA

A. H. GUION & CO.
Contractors
CHARLOTTE, N. C.

Mobile, Alabama, is another American city that has felt the pinch of increased population — and has done something about it! With its many new residential areas and growing industry, the city sanitation facilities were severely overtaxed. The new Eslava Creek Sewage Disposal Plant, completed last year, is the real answer to this problem, providing Commissioner Ernest M. Megginson with adequate facilities for all present needs. As engineered by J. B. Converse & Co., Inc., of Mobile, the 1.5 MGD plant serves 15,000 people, and can be expanded ultimately to double that capacity. For top operating efficiency, the flow of incoming raw sewage is metered by a Builders Kennison Nozzle with Type M Register-Indicator-Recorder conveniently located to furnish a continuous indication of flow, a 12" chart record, and the total quantity on a counter dial. For Bulletins and complete information, address Builders-Providence, Inc. (Division of Builders Iron Foundry), Providence 1, R. I.

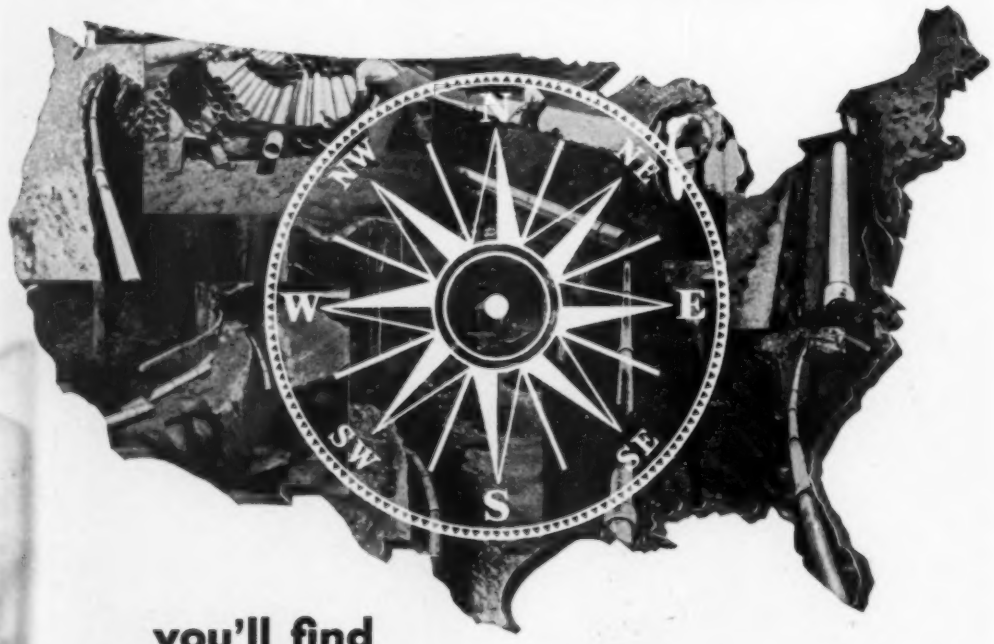
Builders equipment furnished for the Eslava Creek Sewage Disposal Plant:

24" Kennison Nozzle

Type M Register-Indicator-Recorder for sewage influent.

BUILDERS PROVIDENCE
Instruments

Wherever the compass points . . .



you'll find

"CENTURY® PIPE INSTALLATIONS!

In hundreds of communities throughout the nation, "Century" Asbestos-Cement Pipe is at work. These communities already know the cost-saving advantages of "Century" Pipe—they're already enjoying the maintenance-free service that comes with water mains "built to last."

It is not by accident or chance that "Century" Asbestos-Cement Pipe has steadily gained in favor and use. Increasing recognition of its outstanding qualities has resulted in a growing demand for use in extending water mains in old communities and the installation of water distribution systems in new ones. Every day sees more of it used.

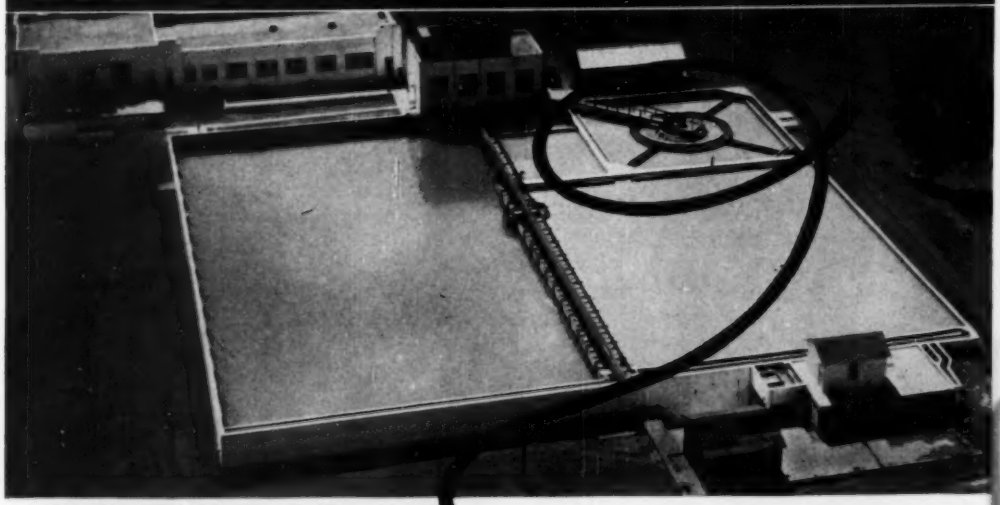
Low cost . . . ease of installation . . . outstanding durability—three big reasons why it will pay you to investigate "Century" Asbestos-Cement Pipe for your next water main installation! Write us for complete information.

Nature made Asbestos . . . Keasbey & Mattison has made it serve mankind since 1873

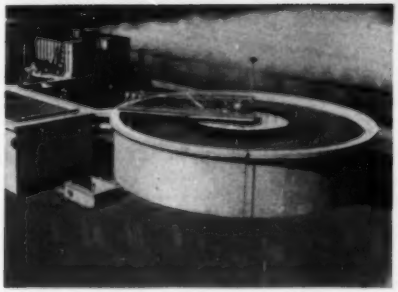
KEASBEY & MATTISON

COMPANY • AMBLER • PENNSYLVANIA

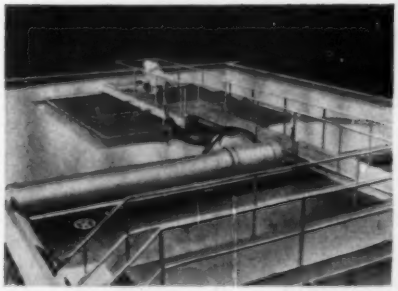
HOW TO TURN AN EXISTING BASIN



Into a Modern Water Conditioning Plant!



ACCELATOR installations: (Above) City of Gainesville, Fla., (Below) City of Coshocton, Ohio.



The ACCELATOR®
MAY BE ROUND OR SQUARE

At Muskogee, Oklahoma, a cyclone severely damaged the water treating plant. In rebuilding, they placed a *square* Accelator within the still-standing square settling basin. This saved the extra cost of building an external *round* basin. Today, the compact 70 ft. square ACCELATOR turns out 50% more clarified and softened water than the 210 ft. square settling basin did before! ★ Square, or round, the Accelator gives *any* municipality the means of converting turbid or hard water into a sparkling, clear, soft effluent. Over 1100 Accelator installations economically treat more than *One Billion* Gallons of water *every day!* Get all the facts.

SEND FOR..

our colorful new 28-page Bulletin No. 1825. It's packed with vital information about this better, more economical way to condition water.

INFILCO

• BETTER WATER CONDITIONING AND WASTE TREATMENT SINCE 1894 •

INFILCO INC.

NEW YORK 17 • **TUCSON** • CHICAGO 16

SALES OFFICES IN TWENTY SIX PRINCIPAL CITIES

WORLD'S LEADING MANUFACTURERS OF WATER CONDITIONING AND WASTE TREATING EQUIPMENT

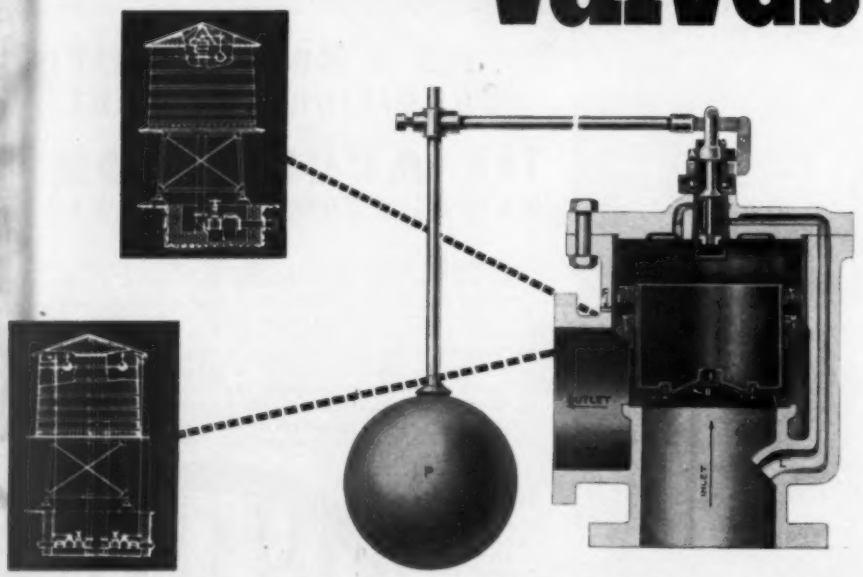
FOR POSITIVE WATER LEVEL CONTROL

under the most difficult, adverse conditions

specify

GOLDEN-ANDERSON

"Cushioned" FLOAT OPERATED *control* Valves



Golden-Anderson engineers have pioneered the development of float operated valves for cold and hot water requirements in elevated tanks. These valves are the quick opening type or semi-throttling design, and arranged with either integral or remote pilot control for differential water level operation.

Write for complete technical data.

LIFE AND PROPERTY PROTECTION
VALVES
FOR OVER 50 YEARS

GA
GOLDEN-ANDERSON *Valve* SPECIALTY CO.
2075 KEENAN BUILDING
PITTSBURGH 22, PA.

WHY SANTA BARBARA'S modern sewage treatment plant includes

THE PROCESS OXIDATOR*

Beautiful Santa Barbara, California was in danger of ruining her fine beaches due to an antiquated method of fine screening sewage and disposing of it through an outfall into the ocean. To prevent pollution of these valuable beaches and to adequately serve a growing population of 60,000 people, a new, modern, improved intermediate type sewage treatment plant is nearing completion with an average design flow of 6 million gallons per day. Treatment includes two single stage, 80 ft. dia. Oxidators, heated digesters, vacuum filtration of digested sludge and chlorination. Koebig and Koebig, Consulting Engineers. Hermann Co., Contractors.

Process Oxidators were specified for the following reasons:

- IMPROVED CLARIFICATION DUE TO SLUDGE RECIRCULATION
- REMOVAL OF SUSPENDED MATTER—70% to 85%
- REDUCTION IN BIO-CHEMICAL OXYGEN DEMAND—50% to 65%
- GREASE REMOVAL—80% to 85%
- ELIMINATION OF ODORS BY MAINTAINING SEWAGE IN FRESH CONDITION
- PROVISION FOR ADDITION OF CHEMICALS FOR SEASONAL PEAK LOADS
- LOWER CAPITAL COST AND UPKEEP

Every installation of the Process Oxidator proves this revolutionary new sewage treatment process *gives the results of intermediate treatment at practically the cost of primary treatment.*

*Patented and Patents Pending.

For complete information regarding this one tank combination aeration, coagulation and sedimentation process send for Bulletin 106. Or if you have a particular problem, write to either address below and one of our specialized Engineers will be glad to assist you.

PROCESS ENGINEERS INCORPORATED

821 MARKET STREET
SAN FRANCISCO 3, CALIF.

6381 HOLLYWOOD BLVD.
LOS ANGELES 28, CALIF.

EASTERN AND MIDDLE WESTERN REPRESENTATIVE:
PACIFIC FLUSH-TANK COMPANY • 4241 RAVENSWOOD AVE., CHICAGO 13, ILL.

A Dresser-coupled steel line delivers water cheaper...

The cheapest way to deliver water to the place where it turns into revenue is with a Dresser-coupled steel line—the line that

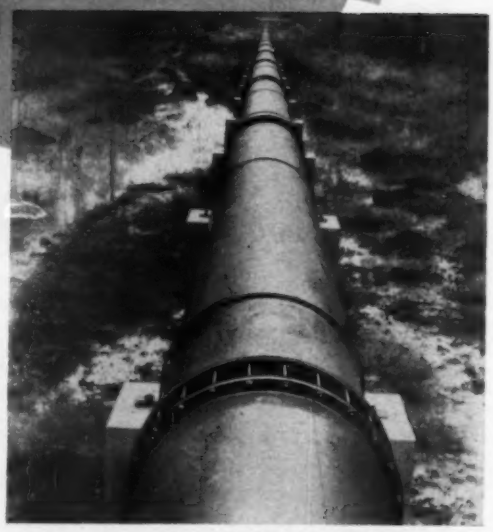
- **Cuts installation costs**
- **Cuts leakage losses**
- **Cuts maintenance costs**

Water supply lines frequently must cross marshy or unstable ground. In such locations, steel pipe, joined with flexible Dresser Couplings, offers unusual economies.

The greater beam strength of steel pipe keeps the number of pile bents or other pipe supports at a minimum. Less cumbersome steel pipe is easier to handle—and with Dresser Couplings, the amount of heavy equipment required is small. The longer pipe sections reduce the number of field joints to be made.

Easy to install, absolutely tight, Dresser Couplings speed pipe joining, absorb normal expansion-contraction stresses, and guard your line against possible infiltration of polluted ground water through joints should internal line pressure drop. Joining crews are small, easy to manage, and need have no special skills. Joints *stay* tight—cut maintenance to the bone.

Write today. Find out how your proposed line can "Deliver Water Cheaper".



In Georgia, Savannah's new 42" Dresser-coupled steel supply line crosses swampy ground on concrete cradles supported by wooden piles. Beam strength of the steel pipe kept the number of supports at a minimum. Flexibility of couplings protect line against stresses.

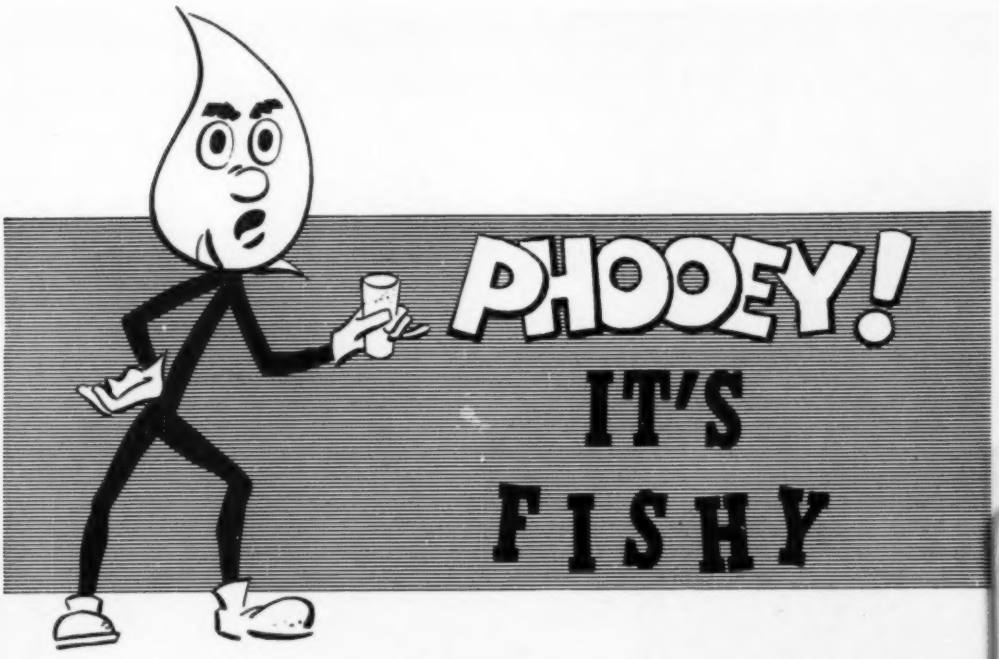
BE SURE you get the best line at the best price. Put steel pipe and Dresser Couplings in your specifications.

DRESSER

"FLEXIBLE-TIGHT"

COUPLINGS

Dresser Manufacturing Division, 59 Fisher Ave., Bradford, Pa. (One of the Dresser Industries)—In Texas: 1121 Rothwell St., Houston. In Canada: 629 Adelaide St., W., Toronto. Sales Offices: New York, Philadelphia, Chicago, Houston, San Francisco.



No one yet knows the exact chemical composition of algae, but it is common knowledge that algae cause tastes and odors in water supplies. These odors are characterized as fishy, aromatic, grassy, earthy, etc., and when they reach a taste-odor intensity of more than 5, consumer complaints are in order.

Aqua Nuchar Activated Carbon removes algae-caused tastes and odors from water because it actually removes the odorous compounds by adsorption. This Aqua Nuchar action is purely physical, so that the tastes and odors are removed from the water when the activated carbon is filtered out . . . not merely changed or reduced by chemical reaction.

The Technical Service Department at our nearest sales office will be glad to discuss your taste and odor problems with no obligation on your part.

OTHER PRODUCTS:

Snow Top Precipitated Calcium Carbonate—Nuchar Activated Carbon—Liqro Crude Tall Oil—Tallene Tall Oil Pitch—Indusoil Distilled Tall Oil—Tallex Abietic Acid—Polycel Cellulose Fibers—Indulin (Lignin)

INSURES PALATABLE NUCHAR DRINKING WATER

industrial CHEMICAL SALES

division west virginia pulp and paper company

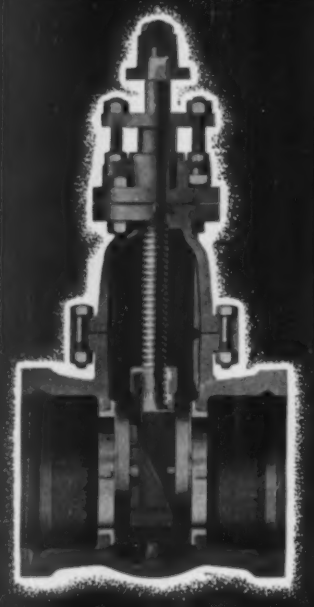
NEW YORK CENTRAL BLDG.
230 PARK AVENUE
NEW YORK 17, N.Y.

LINCOLN-LIBERTY BUILDING
BROAD AND CHESTNUT STREETS
PHILADELPHIA 7, PA.

LEADER BLDG.
526 SUPERIOR AVE., N.W.
CLEVELAND 14, O.

PURE OIL BLDG.
35 E. WACKER DRIVE
CHICAGO 1, ILL.

How Darling features prevent trouble and expense



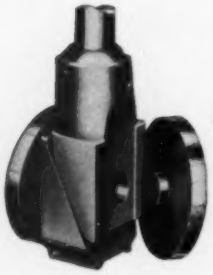
"This advertisement is one of a series showing how the unique Darling Fully Revolving Double Disc Parallel Seat Gate Valves answer the following critical operating problems:

- Positive, easy closing—regardless.
- Automatic adjustment for valve body distortion.
- Elimination of disc-to-seat friction and galling.
- Uniform wear distribution.
- Extreme simplicity.
- Greater service life.
- Simplified maintenance.

CORROSION RESISTANT VALVES

In addition to conventional iron, bronze and steel constructions, Darling specializes in valves for any corrosive fluid: iron body valves with special alloy trim; iron body, rubber lined, with special alloy trim; all bronze; and all special alloy. Darling's 50 years of experience in meeting unusual requirements is always at your service.

UNIFORM WEAR DISTRIBUTION



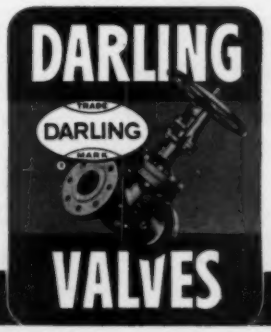
A LARGE percentage of valve leaks, lost time, expense, can be blamed on uneven wear—the uneven wear caused by repeatedly exposing the same disc and seat areas to concentrated pressure, fluid flow, and resultant galling from operation.

For years such leaks were considered the result of normal, expected wear. But the unique design of Darling Double Disc Parallel Seat Gate Valves has proved that uneven wear can be prevented. The two valve discs shown in the cutaway view, and again in the removed inside assembly, are separately and independently hung and free to revolve through their 360°. Valve operation aids the action during the lowering and raising of the disc assembly. The discs never seat twice in the same position and obviously wear is bound to be uniform. This results in tight closure even when the disc faces are worn.

Hundreds of Darling gate valve users have learned by experience that uniform wear distribution results in longer service life and correspondingly lower maintenance cost.

DARLING VALVE & MANUFACTURING CO.
Williamsport 11, Pa.

Outline your service requirements and get complete ***information on Darling Valves of the proper type. Or, send for the complete 300-page Darling Catalog No. 17M. It describes Darling Valves of*** all ***types for every normal or unusual service, and for pressures up to 1500 pounds. It's full of helpful information . . . Yours for the asking.***



THE VALVE MARK OF QUALITY . . . WATCH FOR IT

2,250,000-gal. steel water tank of Woodlawn Water Company, Aliquippa, Pa., protected inside and out with Dearborn NO-OX-IDs.

HOW DEARBORN NO-OX-ID PROTECTS THIS 2,250,000-GAL. STEEL TANK AGAINST RUST

More than two years ago this 2,250,000-gallon steel water storage tank was protected against rust with Dearborn NO-OX-ID.

The method was simple. Removal of all rust and scale by wire brush came first. Next, a 1/16th-inch coat of NO-OX-ID "A Special" was applied to the interior. Then the exterior was prime-coated with NO-OX-ID Filler Red C and finished with NO-OX-ID Gloss Filler Black. Since then, no additional maintenance has been required, and a recent inspection indicated none will be needed in the foreseeable future.

Investigate this modern way to protect your valuable equipment against rust. A Dearborn sales engineer will assist you in selecting the correct NO-OX-IDs for your needs.

DEARBORN CHEMICAL COMPANY
310 S. Michigan Ave. • Chicago 4, Ill.

WRITE FOR "NO-OX-ID VERSUS WATER"

An interesting, illustrated booklet which tells the story of NO-OX-ID rust preventive protection in the water works field.

DEARBORN CHEMICAL COMPANY
310 S. Michigan Ave., Dept. WS
Chicago 4, Illinois

Gentlemen:

Please send me a copy of "NO-OX-ID versus WATER."

Name.....

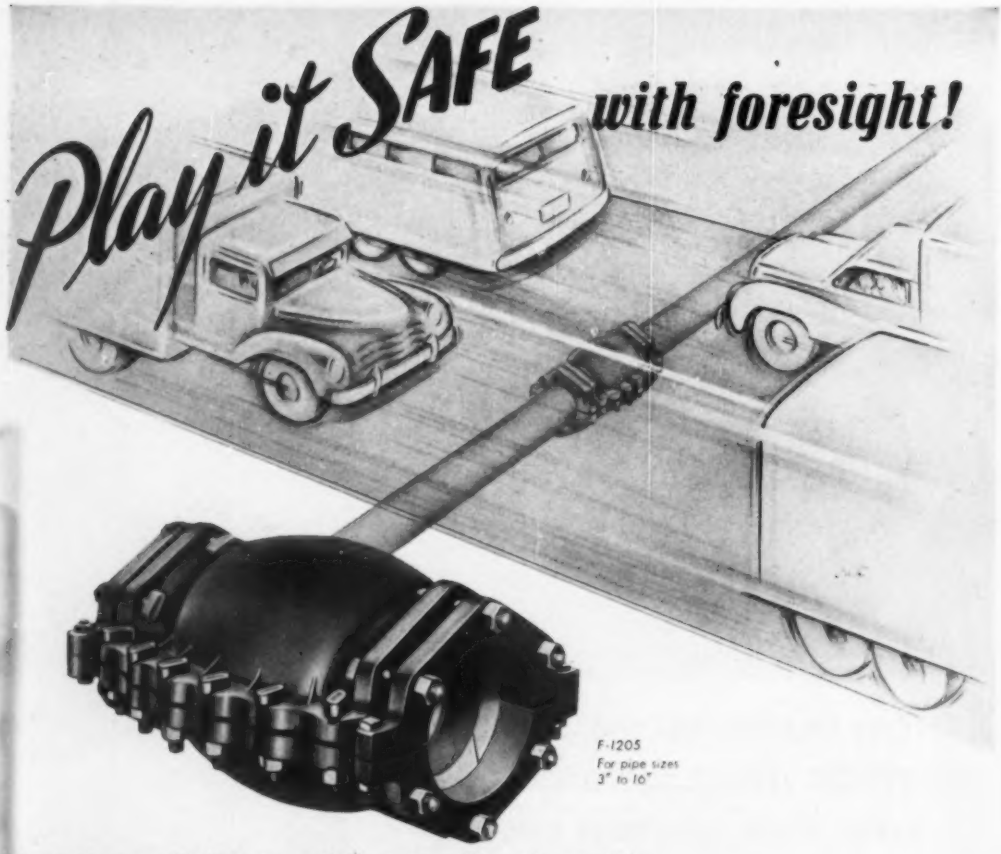
Company.....

Address.....

City.....*State*.....

Dearborn
Reg. U. S. Pat. Off.
THE ORIGINAL RUST PREVENTIVE
NO – OX – ID
IRON + = RUST

Play it SAFE with foresight!



F-1205
For pipe sizes
3" to 16"

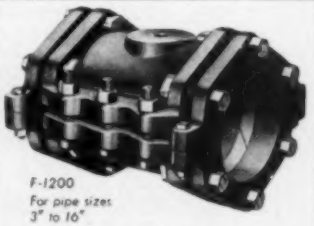
Reinforce all joints subject to vibration with

CLOW

Mechanical Joint BELL SPLIT SLEEVES

When ponderous trucks roar and rumble by, even our finest highways tremble with vibration . . . and so does the water pipe buried below! That's why it's best to play it safe: don't wait for a break; have the foresight to install Clow Mechanical Joint Bell Split Sleeves as *original equipment* wherever the pipe must pass under highway truck routes or under railroad tracks. Specify them for marshland or under water, too—in fact, everywhere that pipe is not readily accessible in case of emergency. They're easy to install . . . no lead, no jute, no caulking!

Write for circular with helpful information and illustrations



F-1200
For pipe sizes
3" to 16"

Use these F-1200 Clow Mechanical Joint Straight Split Sleeves for permanent repairs to pipe barrels. 12" and smaller sizes will repair lengthwise breaks up to 8 inches; 14" and 16" sizes, up to 17 inches.

JAMES B. CLOW & SONS

201-299 North Talman Avenue • Chicago 80, Illinois

and their National Cast Iron Pipe Division, Birmingham, Alabama; subsidiaries Eddy Valve Company, Waterford, N.Y.; Iowa Valve Company, Oskaloosa, Iowa

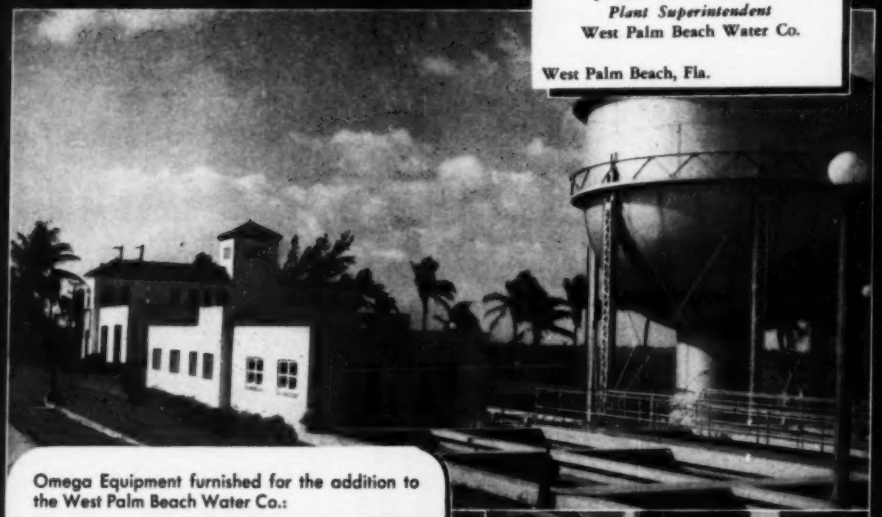
WEST PALM BEACH, FLA.

West Palm Beach Water Co.

(ADDITION COMPLETED IN 1948)

MALCOLM PIRNIE
ENGINEERS
New York, N. Y.

JOHN G. SIMMONS
Plant Superintendent
West Palm Beach Water Co.
West Palm Beach, Fla.

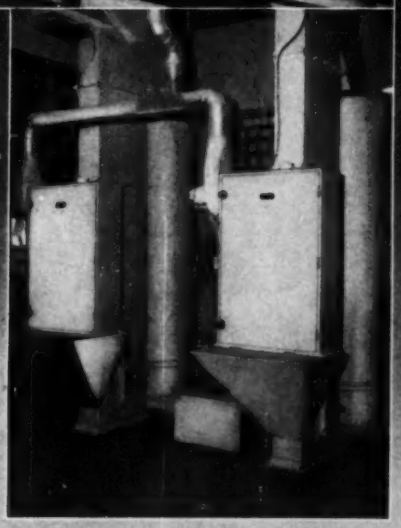


Omega Equipment furnished for the addition to the West Palm Beach Water Co.:

Two Model UF-2 Universal Feeders, complete with bin level indicators, extension hoppers, bucket elevators, dust collectors, and platform scales.

With the rapid growth of West Palm Beach, the city's water supply facilities were found to be inadequate for the increased demands of the population. To remedy this situation a new addition to the handsome West Palm Beach Water Company was recently built, expanding plant capacity to 26 MGD. The enlarged rapid sand filter plant now furnishes a water supply that in quality and quantity amply meets the needs of the 50,000 population served.

To handle the feeding of hydrated lime for the water treatment process, Omega chemical feeding equipment was installed in the new addition. Similar equipment, in continuous service at the original plant since 1937, had proved so satisfactory that Omega Equipment was again selected for the West Palm Beach Water Co. For Bulletins describing Omega Water Works Equipment, address Omega Machine Company (Division of Builders Iron Foundry), Providence 1, R. I.



THE LAST WORD IN FEEDERS
OMEGA

piping maintenance costs more now!

You do less of it

by using Dependable Quality

CRANE VALVES

That's why more Crane Valves are used than any other make

. . . no bonnet trouble with this valve

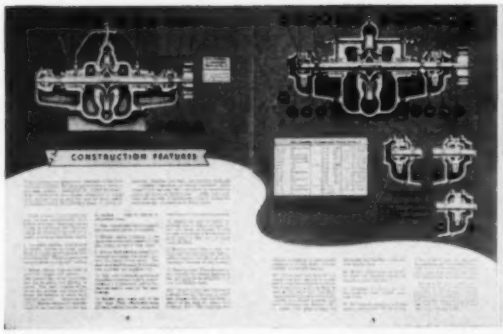
A typical example of low-maintenance Crane Quality—No. 465½ 125-Pound Iron Body Gates. Rarely does the bonnet joint need attention. Flange construction includes reinforcement to prevent distortion and utilizes more bolts, more closely spaced than is usual in valves of this class. Crane precision-guided seating reduces seat and disc wear. Packing has long life because these valves have a deep stuffing box filled with high grade asbestos ring packing. A ball-type gland equalizes the packing load.

Better performance features like these make Crane the better buy in valves of every type. Ask your Crane Representative for a demonstration.

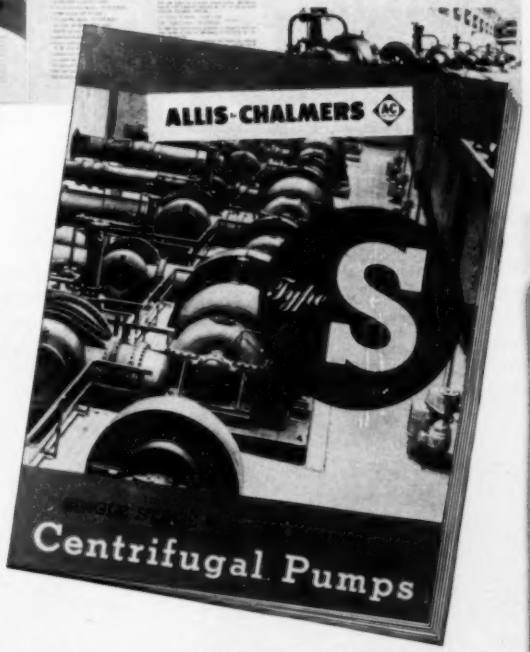
CRANE

CRANE CO., *General Offices:*
836 S. Michigan Ave., Chicago 5, Ill.
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING



How to Select and Apply Pumps



New Bulletin Gives Facts On —

- **How to figure pumping heads**
- **Tables of pipe friction losses**
- **7 pages of Head-Capacity tables**
- **Detailed cross-section drawings**

TWENTY FOUR PAGES packed with the kind of engineering data that you'll want to keep for your files . . . and it's yours for the asking!

Contains: detailed cross-section drawings of the latest Allis-Chalmers pumps . . . seven solid pages of head-capacity tables covering hundreds of pump sizes . . . rules and constants plus instructions for figuring pumping heads . . . two full pages of tables showing friction losses for water per 100 ft of pipe . . . and pages more of important pump facts.

Buy "A-C" For Equipment Coordination

You can get a more complete package of equipment from Allis-Chalmers and *know* where responsibility lies. For example, A-C can furnish pump, motor and control together — in a single package!

If your community is planning *any* public works improvements, call in your nearest A-C Sales Representative.

Texrope is an Allis-Chalmers trademark.

SEND COUPON TODAY

ALLIS-CHALMERS, 1192A SO. 70 ST.
MILWAUKEE, WIS.

Please send me Bulletin 08B6146A, "Allis-Chalmers Type S, Single Stage, Double Suction Centrifugal Pumps."

Name.....

Company.....

Street.....

City.....

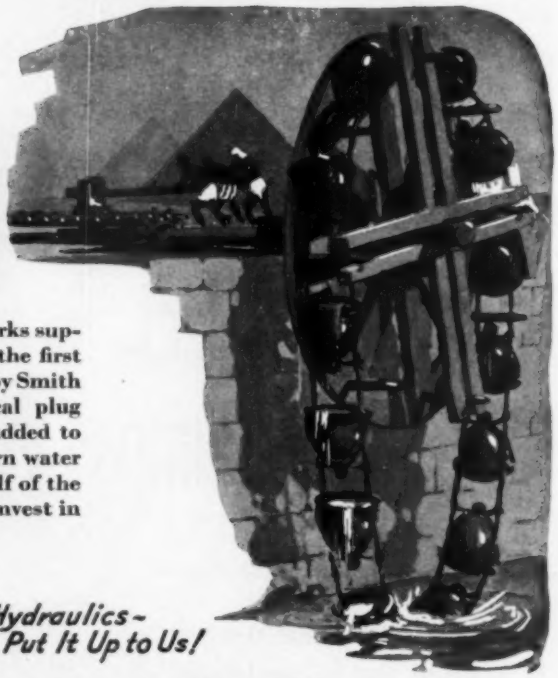
State.....

A-3078

ALLIS-CHALMERS

World's Widest Range of Public Works Equipment

Modern WATERWORKS *possible with* Rotovalves *by* SMITH



MOVING ever onward, the huge water works supply systems of today have evolved from the first crude inventions of antiquity! Rotovalves by Smith with their full circular openings, conical plug and electrically welded seat rings have added to the efficiency and reliability of the modern water works and sewage systems. Assure yourself of the utmost return on your Valve Dollar and invest in Rotovalves. Write for our bulletin.

If It's Hydraulics – Put It Up to Us!

S. MORGAN SMITH Co.

YORK, PENNA. U.S.A.

NEARLY

7/8

OF THE WATER YOU *SUPPLY* MUST ALSO BE *REMOVED!*

Your complete city water pumping cycle from supply through disposal can be efficiently and economically handled by one make of pump

PEERLESS PUMPS

FOR WATER SUPPLY

Peerless Deep Well or Close-Coupled Turbine Pumps for underground or surface lifts. Capacities up to 30,000 gpm and heads to 1,000 ft.

FOR BOOSTING

Peerless Horizontal Centrifugal Type A or Type TU for circulation and boosting under pressure. Capacities up to 70,000 gpm and heads to 300 ft.

LOOK TO THE LEADER

LOOK TO PEERLESS

FOR UNDIVIDED RESPONSIBILITY FOR THE WHOLE JOB

Cut your time, investment and maintenance by standardizing on Peerless as your one source of pumps

FOR SEWAGE DISPOSAL

Peerless vertical and horizontal Non-clog Sewage Pumps. Capacities up to 7,000 gpm and heads to 70 ft. Positive operation on solids in suspension.

FOR DRAINAGE

Peerless Hydro-Foil Pumps in propeller and mixed flow types for moving water in large quantities. Capacities up to 220,000 gpm and heads 2 to 60 ft.

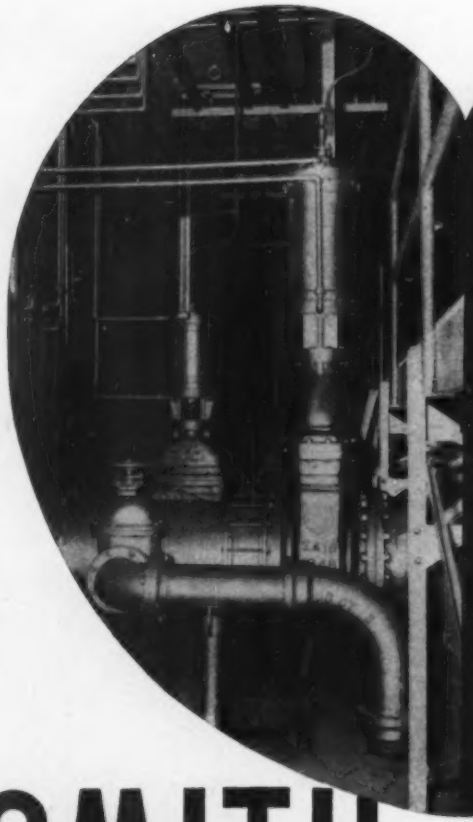
Individual descriptive and illustrated Bulletins are available on each of these types of Peerless pumps. Write for your copies.

PEERLESS PUMP DIVISION

FOOD MACHINERY AND CHEMICAL CORPORATION

Factories: Los Angeles, California and Indianapolis, Indiana.

Offices: New York, Atlanta, Chicago, St. Louis, Phoenix, Fresno, Los Angeles; Dallas, Plainview and Lubbock, Texas; Albuquerque, N. M.



THE HEART OF THE RICHMOND FILTER PLANT

SMITH VALVES

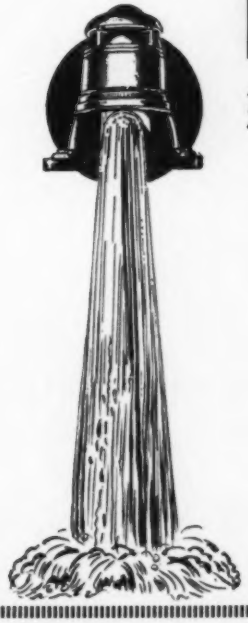
Heart of the new Richmond Filter Plant are a number of Smith-designed, Smith-built, Richmond Specification 300 lb. test Pressure Gate Valves. Valves vary from 8″ to 30″ in size and are continually being opened or closed for accurate regulation of the flow of raw water, wash water and filtered water. Most of the Valves are hydraulically operated of the Square Bottom Case and Disc Type with wash water Valves provided with throttle track construction. Long life is assured by the Square Bottom construction which prevents the downstream disc tilting into the port opening and minimizes disc and seat ring wear. The Cast Iron Brass Lined Hydraulic Cylinders were fitted with limit switches with red and green lights indicating the fully closed or fully open Valve positions. This construction eliminated the need of complicated mechanical position indicators. Wash water piping expansion and contraction is compensated for by using Valves with a flanged and a plain end to accept a mechanical joint coupling. All Valves supplied by Smith for the Richmond Filter Plant were skillfully designed, engineered and ruggedly constructed for dependable long life service under frequent and severe operating conditions. Write for information on Smith Filter Plant Valve design.

THE A.P. SMITH MFG. CO.

EAST ORANGE. NEW JERSEY

★

LAYNE OFFERS a wide range of fully illustrated catalogs and folders describing Layne Well Water Systems, Oil and Water Lubricated Vertical Turbine Pumps, Short Coupled Service Pumps, Cemented Wells, Screens for Gravel Wall Wells, Irrigation Pumps, etc. Write for your copy. No obligation.



EXTRA FINE QUALITY JUST ISN'T ENOUGH

Quality in a Well Water System or a Vertical Turbine Pump cannot be designated as the one and only element that makes them worthwhile. To quality, so Layne has long known, there must be added a lot of very skillful designing, extra precision in building plus the overall know-how that can only come from years and years of world-wide experience. The net result of such a combination is something that lasts, gives satisfaction and brings credit to the name Layne.

Layne is primarily interested in selling a constant, dependable and economical water supply. To do this successfully, Layne has long been the producer of the finest water supply equipment the world has ever known.

It is such a service and such fine equipment that you buy when you become the owner of Layne Well Water Systems and Layne Vertical Turbine Pumps. They are more widely used than any other make in the entire world—a wonderful tribute to their excellence.

For further information, catalogs, etc., address

LAYNE & BOWLER, INC.

General Offices, Memphis 8, Tenn.

LAYNE

WELL WATER SYSTEMS

VERTICAL *Turbine* PUMPS

LAYNE ASSOCIATED COMPANIES

ASSOCIATED COMPANIES—Layne-Arkansas Co., Stuttgart, Ark. ★ Layne-Atlantic Co., Norfolk, Va. ★ Layne-Central Co., Memphis, Tenn. ★ Layne-Northern Co., Mishawaka, Ind. ★ Layne-Louisiana Co., Lake Charles, La. ★ Louisiana Well Co., Monroe, La. ★ Layne-New York Co., New York City ★ Layne-Northwest Co., Milwaukee, Wis. ★ Layne-Ohio Co., Columbus, Ohio ★ Layne-Pacific, Inc., Seattle, Wash. ★ The Layne-Texas Co., Ltd., Houston, Tex. ★ Layne-Western Co., Kansas City, Mo. ★ Layne-Minnesota Co., Minneapolis, Minn. ★ International Water Corp., Pittsburgh, Pa. ★ International Water Supply, Ltd., London, Ont. ★ Layne-Hispano Americana, S.A., Mexico, D. F. ★ General Filter Company, Ames, Iowa.

"SEMPER PARATUS"

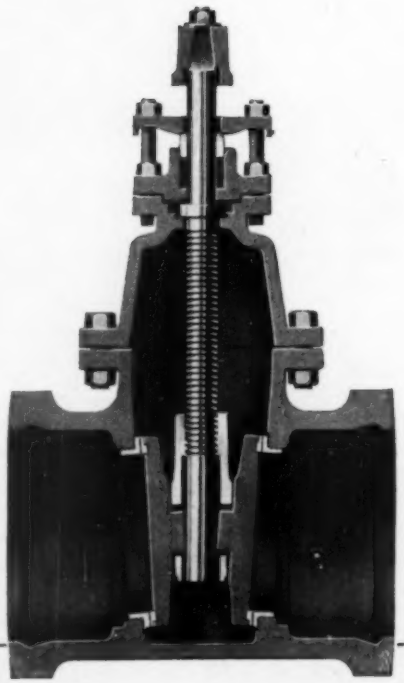
The Coast Guard motto, "Always Ready," tells the most important characteristic of R. D. Wood Gate Valves—they are always ready, even after years of idleness.

R. D. WOOD GATE VALVES can be buried deep underground with full assurance that they will give long years of service with minimum maintenance. The design is of calculated simplicity. The usual small wedges and delicate parts are avoided entirely. There are no pockets to fill up with sediment and scale that might cause jamming, and the flow of water is unobstructed at open position.

For a dependable water system, specify R. D. Wood Gate Valves.

Send for complete information today.

BE EXTRA SAFE . . .
OPERATE ALL VALVES AT LEAST ONCE A YEAR



R. D. WOOD COMPANY

Public Ledger Building, Independence Square
Philadelphia 5, Pa.

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe (centrifugally cast in sand molds)

Only three moving parts—the spreader and two discs. In opening, the discs are lifted into the bonnet entirely clear of the seats. In closing, they are wedged into place without distortion. Seasoned castings. Rigidly inspected. For working pressure up to 175 lbs. Tested to 300 lbs. Conforming to AWWA specifications. Supplied with bell, flanged or mechanical joint pipe connections.

"Signposts" of Progress

in BETTER WATER STORAGE

Elevated Steel Tanks

by

PITTSBURGH •DES MOINES

Dependable water service for the progressive community is marked with distinction by P-DM Elevated Steel Tanks. Handsome in appearance, efficient in performance, economical to use and maintain, Pittsburgh-Des Moines Tanks are always a sound investment. *Write for our latest Water Storage Brochure.*

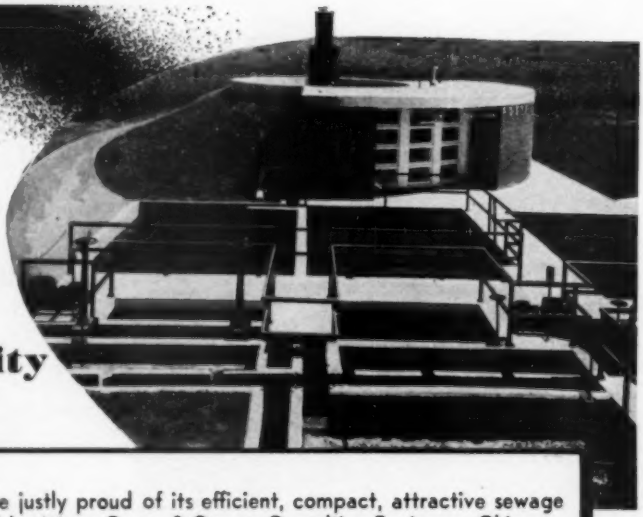
PITTSBURGH • DES MOINES STEEL CO.

Plants at PITTSBURGH, DES MOINES and SANTA CLARA

Sales Offices at:

PITTSBURGH (25)	3414 Neville Island	DES MOINES (8)	919 Tuttle St.
NEW YORK (7)	Room 918, 270 Broadway	DALLAS (1)	1223 Praetorian Bldg.
CHICAGO (3)	1222 First National Bank Bldg.	SEATTLE	926 Lane Street
	SANTA CLARA, CAL.	625 Alviso Road	

attractive and efficient sewage treatment plant for a small community

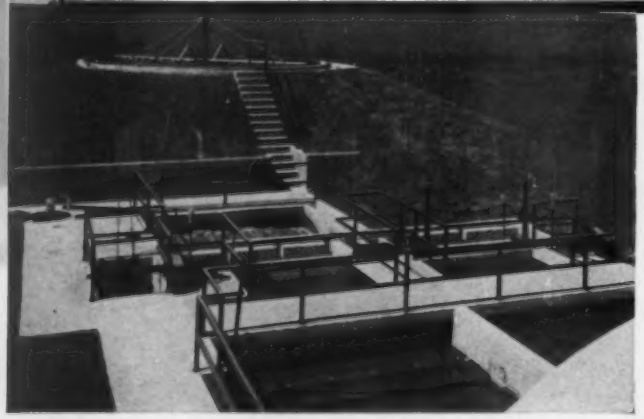


POSTVILLE, IOWA, can be justly proud of its efficient, compact, attractive sewage treatment plant, designed by Marr, Green & Opper, Consulting Engineers, Chicago. The design is for a population of 3,200.

The control building partially encircles the 20'-0" diameter digestion tank, equipped with P.F.T. Floating Cover. The rear wall of the control building is formed by the digester wall. This construction has resulted in reduction in initial cost and saving heat requirements for the building and digester.

Just outside the building can be seen part of the P.F.T. Preaeration system ahead of the primary clarifier. This system includes P.F.T. vertical aeration plate holders.

Opposite the digester and control building is a P.F.T. Rotary Distributor of the high rate type for a 28'0" diameter filter bed, for a recirculated flow of 250 g.p.m. Two arms of the distributor are equipped with P.F.T. siphonic low loss overflows.



In addition to blower, pumps and control piping, the control building houses a No. 100 P.F.T. gas and oil fired Digester Heater and Heat Exchanger unit equipped with basic controls, a P.F.T. Supernatant Selector, Supernatant Gauge, and Sight Glass and Sampler unit. Also included is P.F.T. Gas Safety equipment of the 2" size.

Recirculation through heater of digester contents is continuous. Heater provides both heating of digester and control building.

P.F.T. PACIFIC FLUSH TANK CO.

SEWAGE TREATMENT EQUIPMENT EXCLUSIVELY SINCE 1893

4241 RAVENSWOOD AVENUE CHICAGO 13, ILLINOIS

NEW YORK • LOS ANGELES • SAN FRANCISCO • CHARLOTTE, N. C. • DENVER • TORONTO

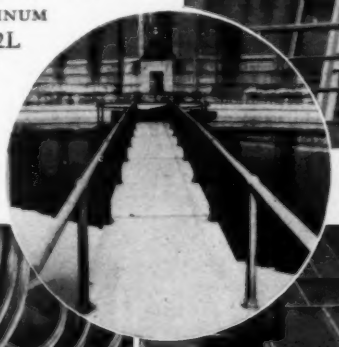
SEVENTEEN-YEAR UPKEEP: ZERO

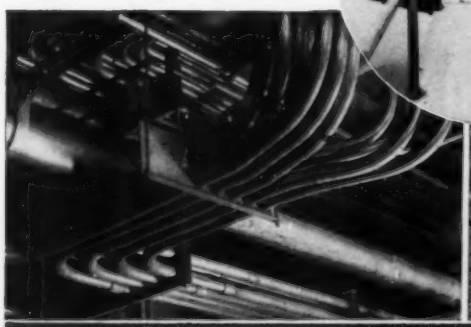
Cleveland's Easterly Sewage Treatment Plant proves you can combine exceptional attractiveness with economy.

Easterly's Superintendent says, "The Alcoa Aluminum windows, door frames, floor gratings and conduit have given satisfactory service for the past seventeen years . . . have required no maintenance expense for painting or repairs".

There are hundreds of similar installations. Bar screens, rotary distributors, weirs, scum troughs, slide gates and architectural features that haven't needed a dime's worth of maintenance in 10, 15, even 20 years.

Builders are glad to fabricate equipment of light, lasting Alcoa Aluminum. You need only specify Alcoa in your designs. For more information, mail the coupon below to ALUMINUM COMPANY OF AMERICA, 2162L Gulf Building, Pittsburgh 19, Pennsylvania.





Architectural applications of Alcoa Aluminum in Cleveland's Easterly Sewage Disposal Plant. Consulting engineers were Havens & Emerson, successors to George B. Gascoigne & Associates.

ALCOA

FIRST IN ALUMINUM

Gentlemen:
Please send more information to:

Name_____

Title_____

Company_____

Address_____

City_____ State_____

TYLOX RUBBER JOINTS

COVINGTON'S 42" concrete sewer on Second Street, laid in connection with Kentucky's Flood Wall Project, posed some tough problems for the Army Engineers in charge.

The sewer paralleled the Ohio River. The ditch was wet, it had to be sheeted and braced, the pipe swung into position, coupled and the ditch back-filled as quickly as possible to prevent cave-in.

Not only did the line have to be laid in a hurry — it had to be tight and stay tight in the face of shifting soil and soil stresses. Leaky joints could seriously affect the efficiency of the flood wall.

Tylox-coupled joints were specified, for rubber gaskets are a natural on tough jobs like this. Big bore sewer pipe can be coupled faster with rubber joints than any other way. And because there is no waiting for grout to harden before inspection can be made, back-filling can proceed immediately. The compression seal formed by Tylox gaskets assures a water-tight line; the flexibility of the joint enables the line to withstand soil stresses, helps make sure the line stays permanently tight. For a permanently tight sewer line — there's one sure answer: Tylox rubber joints.

MAKING JOINTS WITH TYLOX RUBBER GASKETS IS AS SIMPLE AS ABC

Cement tongue and snap on Tylox gasket.

Lubricate sliding surfaces with Tylox Cement.

Shove the pipe home.

Write, wire, or phone for Specification Data and Literature on Tylox Gaskets.

HAMILTON KENT MANUFACTURING CO.

220 GOUGLER AVE. KENT, OHIO TEL. 3449

"THE ONLY PERMANENTLY TIGHT LINES ARE LAID WITH RUBBER JOINTS"

Lithographed on stone by James E. Allen

U.S. CAST IRON PIPE

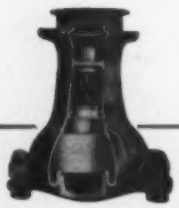
Cast iron pipe is tough, husky, but not exactly handsome. What it lacks in eye appeal it makes up for in dependable quality. To see that our product's reputation for quality is lived up to—and to strive for still higher quality—this Company has made substantial investments in facilities for *quality control* and for *research and development.* The recently completed Research Laboratory and Developmental Foundry at Burlington is an important contribution to a long-range program of process and product development. **United States Pipe and Foundry Company, General Offices: Burlington, N. J. Plants and Sales Offices Throughout U. S. A.**

Metering Alone is NOT Enough

Antigo, Wis. proves the value of PROPER MAINTENANCE	Before MAINTENANCE 1938	After MAINTENANCE 1949
Services metered	92%	99.67%
Number of Services....	1693	2375
% of Pumping ..... registered thru meters	38.5%	89.3%
Annual Consumption... (Gallons per Service)	219,110	109,000

FROM the above, you can realize that it is just as important to MAINTAIN your meters properly as it is to put them in. Antigo proved this, over a ten-year period. The figures speak for themselves.

The cost of pumping, treating, storage, etc., of water saved by water meters properly maintained, plus savings in sewage disposal, is substantially more than the cost of proper meter maintenance.



New improved parts in old Trident Meter

220

NEPTUNE METER COMPANY • 50 West 50th Street • NEW YORK 20, N.Y.
Branch Offices in Chicago, San Francisco, Los Angeles, Portland, Ore., Denver, Dallas, Kansas City, Louisville, Atlanta, Boston.
NEPTUNE METERS, LTD., Long Branch, Ont., Canada

WATER & SEWAGE WORKS

Vol. 97, No. 11 NOVEMBER, 1950

A Gillette Publication

CHARGES FOR PRIVATE FIRE PROTECTION SERVICE*

Policies and Practices of Municipal and Private Water Utilities

by

RICHARD H. ELLIS

Standards Engineer

FACTORY MUTUAL ENG. DIVISION

BOSTON, MASS.

ENGINEERS are today placing more and more dependence on public water systems as a source of primary or initial supply to automatic fire protection sprinklers. Where the properties are large or where there is a high concentration of value, sources of independent secondary water are also provided. Due to the lack of uniformity in individual water works requirements for private fire protection service, it is essential for the fire protection engineer to become familiar with the local requirements when making layouts for the protection of commercial or industrial properties, or when making suggestions for ways and means to improve the efficacy of water supplies, available or potential.

Early in January, 1949, the Factory Mutual Engineering Division sent to approximately 1500 water works throughout this country and Canada, requests for information about their requirements, rates, etc., for private fire protection service. In addition, two general questions were included which were designed to gather information which would indicate how many water purveyors (public and private) are reimbursed by their respective municipalities for public fire protection service and the percentage such revenue would bear to total receipts.

*A paper presented at the 1950 Annual Convention of the Am. Water Works Association and here printed by permission of the Association.

The Author

(Member A.W.W.A. Comm. on Water Rates)

The water works officials to whom these questionnaires were addressed cooperated in an excellent manner. Information was obtained from a total of 1269 different water works (1158 in the States and 111 in Canada) and answers in general, were surprisingly complete. In view of the excellent assistance given the writer in the collection of this information, it seems no more than right that a summary of the data be made available.

Lack of Uniformity in Rates and Requirements

From the information presented herewith, it will be apparent that there is a lack of uniformity among the water utilities as to requirements, rates, etc., for private fire protection service. This, to one who has had both water works and fire protection experience, is not considered to be altogether the fault of water works engineers and operators. However, it does constitute evidence that there are many misconceptions as to the relative water requirements for the protection of sprinklered and unsprinklered properties.

It is recognized that the responsibility of the water works operator is principally the management and operation of a utility, the purpose of which is to provide water for domestic, commercial and industrial use and for *general* fire protection purposes. Usually water works people are well acquainted with public fire protection requirements as established by the National Board of Fire Underwriters. They are also cognizant of the claims of the fire protection interests that less water is required for the protection of sprinklered properties than for unsprinklered properties. Isolated examples have been used to substantiate these claims, but too frequently such information has been offered only in an attempt to bring about a change in local regulations or rates. Seldom has any attempt been made to present factual data which would furnish the water works interests basic information on the comparative demand for water for the extinguishment of fires in sprinkler protected as against unprotected properties.

To clarify some of the apparent misconceptions, the writer, in discussing the results of the Factory Mutual survey, will comment on some of the differences between the water works and fire protection viewpoints and will present the results of an original study conducted to determine the relative water demand created by fires in sprinklered and unsprinklered properties.

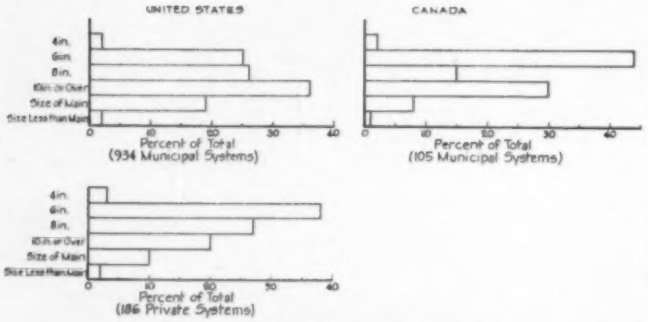


Fig. 1—Sizes of Private Fire Services Allowed

In presenting a summary of the data furnished by the water works officials, reference will be made to the prevailing practices of publicly and privately owned water utilities relative to (1) the maximum size of connections allowed; (2) meter requirements; (3) annual charges, and (4) basis of the charges.

Size of Connections

Figure 1 graphically illustrates current water works practice as it refers to the maximum size of the connections allowed for private fire service. It will be noted that about 2% of the private and municipal water works, both in the States and in Canada, limit the size of the connections to 4-inch. In general, municipal systems permit the use of 6, 8, and 10-inch connections and the practice in private systems is much the same. The trend during the last 10-year period has apparently been to liberalize somewhat the limitations on the size of the connections, a greater percent now permitting 8, 10, 12-inch or over.

The fire protection engineer's interest in the size of the connection to private protection systems is primarily to minimize the friction loss in the connection. To assure effective delivery from a sprinkler system it is usually necessary to maintain 15 to 25 lbs. flowing pressure at the top of the sprinkler risers. Frequently pressure is at a premium and any undue loss of pressure may reduce the effectiveness of the sprinkler protection. On the other hand water works interests have sometimes held that it is desirable to limit the size of the connections to private protection systems to prevent undue reduction of pressure in the public mains in the event of a fire. The inconsistency in this contention appears to be that if an ample supply of water at effective pressure is not initially available to the sprinklers, an ever larger amount will be required for hose streams later.

Meters on Private Fire Services

The installation of commercial type meters on private fire service connections also introduces friction, and the expense of fire service meters is rarely justified. Practically all new sprinkler installations require the provision of flow alarm devices which in many instances are connected to a central station supervisory service. There are numerous other means by which a water utility can supervise fire protection connections. Except in the case of large industrial properties involving a number of buildings with a considerable amount of yard piping, for separate or combined domestic and process purposes, it seldom appears necessary to the fire protection engineer to provide meters. However, where due to local conditions meters the justified, the fire protection interests are particularly anxious that the metering device be of a type that will furnish an unrestricted waterway and will introduce a minimum of friction. These requirements are best met by Detector Check Valves (with metered by-pass), or full-flow Fire Service Type Meters.

Figure 2 illustrates the present requirements pertaining to meters on fire services and it is interesting to note that a majority of the water works recognize this situation and do not require meters. Except in Canada, where meters are required, detector checks or fire service type meters are generally specified. Water works practice in this respect is somewhat more liberal than it was ten years ago. Of those water works that do require meters, there is now a greater percentage specifying a type that is satisfactory from a fire protection viewpoint.

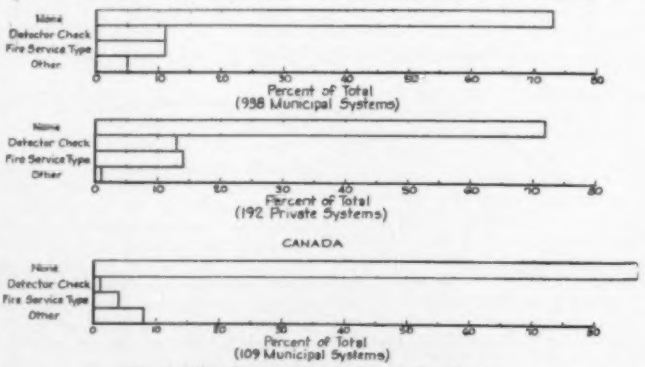


Fig. 2—Meter Requirements for Private Fire Services

Rates for Private Fire Protection

Probably the most controversial subject in discussions on private fire protection is whether or not the water purveyors should make periodic service charges where private fire protection systems are connected to and supplied, in whole or in part, by public water systems.

Returns (Fig. 3) from the survey reveal that 56% of the municipal systems levy no charge for private fire service connections. Practice in Canada is a little more liberal in that 65% of the water works reporting make no charge for sprinkler connections. On the other hand, privately owned works, in the U.S. as a general rule, do charge for private fire service connections but, as will be shown later on, there may be some justification in this as quite a number of the private systems assume the cost of the connection to the property line, in whole or in part. There has been relatively little change in water works practice in this respect, the percentage of municipal plants now making no charge being 4% greater, and the private plants 1% less than in 1939.

The range of annual charges by municipal and private works for 6-inch connections is shown in Fig. 4. This data is predicated on those works whose rates are based on the size of the connections, flat rate charges and

on minimum charges where the rates are based on a combination of the sprinklers, hydrants, size of connection, etc. Of those municipal works which do levy charges on such bases, 57% charge $50 or less for a 6-inch connection per annum. A very small percent have charges that range from $200 up to something less than $500 for each 6-inch connection per annum.

Private practice varies from municipal practice in that only 16% of the charges for 6-inch connections are $50 per annum or less per connection, 61% between $50 and $201 per year and roughly 1% charge over $500 per year for each connection. One water company receives revenue of as much as $960 per annum for each 6-inch connection.

Reference to Fig. 4 indicates that there is very little uniformity in charges levied by municipal works or private companies. How can one justify the fact that 56% of municipal systems make no charge and others charge nearly $500 per year per 6-inch connection, or in the case of privately owned plants, nearly 10% make no charge and others charge as high as $960 per year for the same service? Certainly the amount of the charge is no index of the ability to render service. This is evidenced by the fact that in some of the locations where the rates are highest the water supply is entirely inadequate from a fire protection viewpoint.

While the usual charge per sprinkler head is between 1c and 10c per annum, some of the new rate schedules establish charges as high as 18c to 20c per head. Relatively few works charge more than 20c, although we do have reports of charges as high as 36c and even 63c per head.

The same lack of uniformity again appears when we study the bases for the charges.

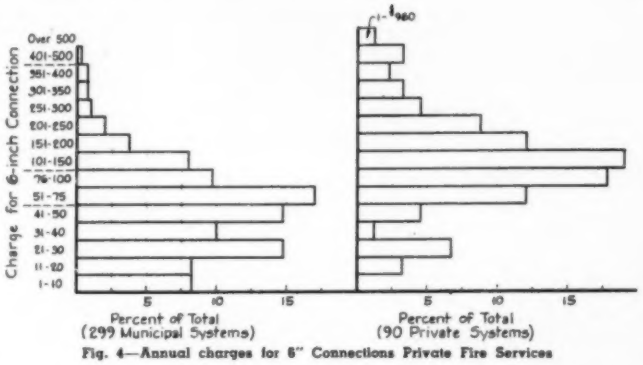


Fig. 4—Annual charges for 6" Connections Private Fire Services

Basis of Charges Lacking in Uniformity

In both public and private practice 45% of the works in the States and 22% of those in Canada base their charges on the size of the connections (Fig. 5). A few works charge on the basis of the number of hydrants only and approximately 5% of all works in the States charge on the basis of the number of sprinklers installed. In Canada the more general practice seems to be to base the charge on the number of sprinkler heads, some 26% of all works charging for private fire protection connections making the sprinkler charge. In all instances there is an appreciable number of works where the charges are based on some combination of the number of sprinklers, the number of hydrants, standpipes, etc. In municipal practice, both in the States and in Canada, numerous rates are predicated not on the size of the connection nor on the number of sprinklers involved, but on a flat charge for the service. Floor area is the basis on which a number of municipal and a few private plants charge for this type of service.

The bases of the charges as adopted by many of the water works authorities appear illogical not only to the fire protection engineer but also to the legal fraternity and financing agencies. If charges, based on the number of sprinklers, or any combination of sprinklers and hydrants or on floor area, are intended to reimburse the water purveyor for the potential demand that might result from the presence of the protective equipment, it is evident that this basis is in error. Studies by the writer indicate that the proportion of the sprinkler heads which would open in any one area as a result of a fire in a sprinklered property is not dependent upon the number of heads therein but upon the occupancy, construction and square foot area involved, and that it is highly improbable that all heads will open in any area in excess of about 5000 sq. ft. Furthermore, these studies indicate that the demand for sprinklers will very rarely exceed 1500 to 2000 gpm., sufficient to supply 75 to 100 heads. Charges based on the total number of heads, (sometimes in different buildings and usually in different areas, or on various floors of multi-story buildings) are not, therefore, representative of the potential water demand at any one time. Consequently, the basis of such charges is not realistic and can not be defended on practical grounds.

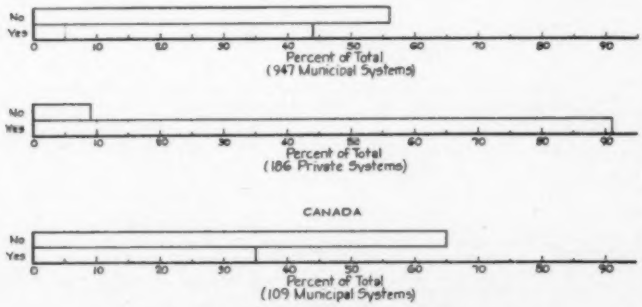


Fig. 3—Annual Charges for Private Fire Services

Installation Costs Also Lack Uniformity

When an application is made for a fire service connection the applicant is usually asked to make a deposit to cover the cost of installation. In Fig. 6 it is revealed that in municipal practice the installation costs are paid by the applicant in 90% of the cases, 3% by the water works, and in 7% of the cases in part by both the water works and the applicant. The private companies, at least on the surface, appear to be more generous in that the entire cost of the connection is borne by the water company in 20% of the cases and in part by the company in 18% of the cases. This, of course, does justify a charge based on the amount invested and on resulting maintenance and depreciation costs. The Canadian practice follows very closely that of the municipal practice in the States.

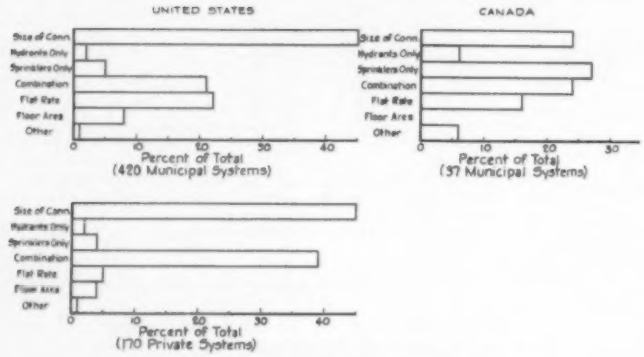


Fig. 5—Basis of Annual Charges for Private Fire Services

Public Fire Service Charges

The two principal functions of a water works are: (1) to provide water for domestic, commercial and industrial use and (2) to provide water for fire protection. The expenses involved in the production of these products, must of course, be recovered and it is logical, in the development of a rate structure, that these costs should be separated one from the other.

Due to the different types of water works systems, to the varying proportions between the domestic, industrial and commercial loads and the peak demand created by fire in communities of different sizes, no one formula by which these costs can be separated is applicable to all cases. Each case must be studied separately. Probably the most noteworthy studies of this nature were those undertaken by Metcalf, Kuichling and Hawley. These studies were published in 1911 in the Proceedings of the American Water Works Association under the title "Some Fundamental Considerations in the Determination of a Reasonable Return for Public Fire Hydrant Service." According to these authorities, the proportion of the capital cost of the works that is devoted to fire protection will vary from about 13% for a community of about 300,000 population to approximately 70% in communities of 5,000 population. This cost must be collected if the works are to be self-supporting and it is therefore a fallacy to consider that any public or private water works whose receipts balance expenses is furnishing "free" water for fire protection. The question of "how" the increment of cost allocable to general fire protection service should be collected is one that continues to be troublesome to water works authorities. In theory it would appear equitable to collect for public fire protection service an amount in proportion to the value of the individual properties protected. The most direct way of doing this would, of course, be for the municipality to appropriate and pay to the water works, an amount equal to the cost of providing fire protection and to collect same from the property owners as a part of the local tax levy.

In Fig. 7 it appears that such procedure is actually followed to some extent in 36% of the municipal systems in the States, 64% of the systems in Canada, and in 89% of the municipalities which are served by private companies. This is encouraging in that the principle that fire protection is a governmental function and should be paid for by the municipality is recognized. It is, however, a fact that there are but few instances where either municipally or privately owned water works are reimbursed sufficiently to cover the probable cost of furnishing this service. The natural hesitancy to add additional increments to present tax burdens is the deterrent to the general adoption of this method of collecting fire protection costs.

In at least one known instance the water bill is divided into two parts; one to cover the amount of water used and the second, based on a rate expressed in mills per dollar of assessed property value, to cover public fire protection cost.

It is a generally accepted fact that a water works should be self-supporting. Rates, whether for water sold, service rendered, or both, should be predicated on the expectation that the total collections will cover all operating and capital costs. In the case of those works where receipts balance expenses but where no contributions or only token contributions are received from the municipality for fire service, is it not evident that the costs of providing all facilities for fire service have been included in the rate schedule? While such a procedure may furnish ample revenue, an apparent inequity results in that the fire protection costs are proportioned on the amount of water consumed rather than on the value of the property protected.

Many of the municipally owned plants pay no taxes and receive no direct revenue from the municipality for public fire protection, and the contention is occasionally offered that the waiver of taxes offsets the cost of providing fire protection. Seldom, however, does this constitute an exchange of equal value. Either the community or the water department loses. For instance, if the tax value exceeds the cost of providing water for fire protection the property owner must stand the loss. On the other hand, where the tax exemption amounts to less than the water department's cost for fire protection, the department must charge the water consumer sufficient to cover the difference. In either case a portion of the fire protection costs must be assumed either by the property owner, as an increment in his taxes, or by the water consumer in his rates. There is no such thing as "free" water for fire protection.

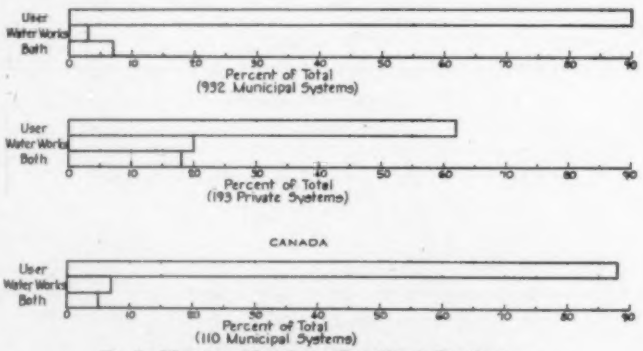


Fig. 6—Allocation of Installation Costs Private Fire Services.

Attention has already been called to the fact that 36% of the municipal plants are directly reimbursed by the municipality to some extent for public fire service. About 24% of all municipally owned works received revenue from *both* private and public fire service. Of the private water companies 89% receive revenue for public fire service and 80% receive revenue from *both* private and public fire service. In Canada a little less than 50% of the water works that are reimbursed for public fire service also receive revenue from private fire service.

Unless it can be established that the water works is rendering to the owner of privately protected property a special service *in addition to* that furnished to the community as a whole, does it not seem that the owner of sprinklered properties who is already bearing his share of the cost of public fire protection in his taxes or water rates (or both) is to some extent being charged twice for the same service? A fair statement would seem to be that justification for charges for private fire protection, in addition to payment for public fire protection, should hinge on whether or not a special service is rendered.

Water Demand for Fires in Sprinklered and Unsprinklered Properties

Contention that a special service is always rendered by the water utility to owners of sprinklered properties appears to be proved fallacious through a comparison of the water demand for fires in sprinklered and unsprinklered properties of the same general type of occupancy. To wit, the curves shown in Fig. 8 have been developed from National Fire Protection Association and Factory Mutual records and cover fires which occurred in cotton storage, cotton textile processing, flammable liquid, machine shop and baled waste paper occupancies.

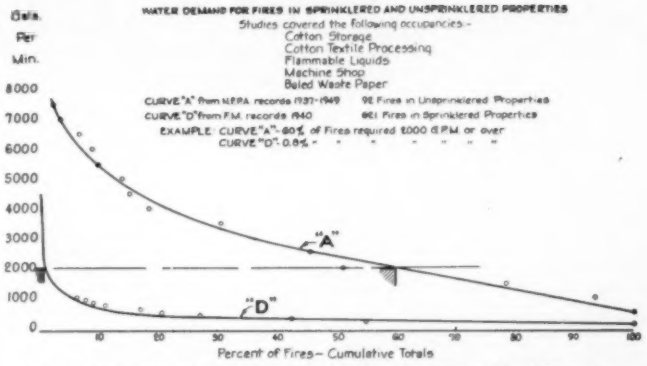


Fig. 8—Comparisons of Water Demands—Sprinklered vs. Unsprinklered Properties

As a rule occupancies of the types studied are sprinklered, and a search of the N.F.P.A. records covering the period from 1937 to 1949 furnished only 92 instances where there was definite evidence as to the water demand in fires occurring in unsprinklered properties containing these occupancies. The water demand at these fires is represented by Curve "A", while Curve "B" has been plotted from the 1940 Factory Mutual record of 621 fires in sprinklered properties of similar occupancies. While the data on unsprinklered properties is limited, comparison of these two curves furnishes glaring evidence that the water demand in sprinklered properties is but a small portion of that which is experienced to fight fires in unsprinklered properties of the same class of occupancies.

It is quite evident from studies of this nature that, if a water system is properly designed to furnish public fire protection service such as would be required for the extinguishment of fires in unsprinklered properties, the same service will be much more than is needed for the supply required in sprinkler protected properties. For instance, as against 100% of the fires in non-sprinklered properties there are only 15% of the fires in sprinklered properties that required 500 gpm. or more of water for *both* automatic sprinklers and hose streams. Similarly, only 1% of the fires in sprinklered properties required 2000 gpm. or more, whereas 60% of the fires in unsprinklered properties required 2000 gpm. or more.

While there are various contentions as to why charges for private fire protection are justified, the writer has the impression that, largely because of the lack of reliable data some water works men feel that an automatic sprinkler system creates an additional potential load on the water works plant and that the demand by sprinklers requires a special "ready to serve" service in addition to that rendered in furnishing the regular public fire protection service. The writer's studies fail to show justification for such contention.

On what grounds can any portion of the total water works cost of providing general fire protection be allocated to private fire protection service, provided the latter creates less of a water demand than the former, while involving no additional cost to the water works? From the viewpoint of the fire protection engineer, such a division is impossible of accomplishment. In this, many water works authorities apparently agree, as evidenced by the fact that it is the policy and practice of more than half of all municipally owned water utilities to make no charge of any nature for private fire protection. On the other side 44% levy various charges, apparently on the assumption that a special service is being provided. However, there seems to be no uniform method or well defined grounds on which they can support this theory, or separate the cost of public and private fire protection service.

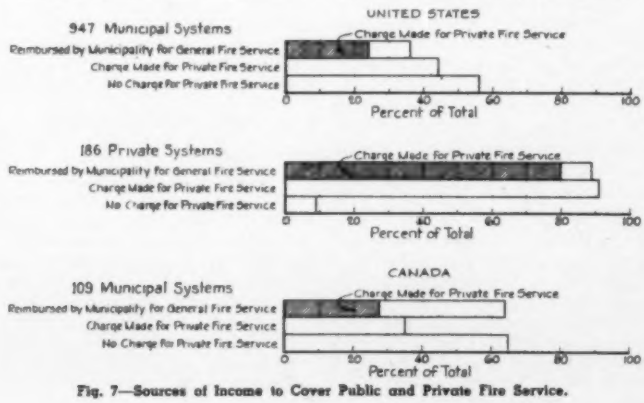


Fig. 7—Sources of Income to Cover Public and Private Fire Service.

LONDON'S WATER SUPPLY

(A Thumbnail Sketch)

by

E. S. BONIFACE*

LONDON, ENG.

During the 1,900 odd years London has been in existence it has grown from a small town of 10,000 inhabitants in the days of Rome to today's huge metropolis of eight million. Its water supply has grown with it, from the period when natural wells and springs were sufficient for all needs until today, when 6,200 people are employed in the business of providing London's water.

In 1902, an Act passed by Britain's Parliament founded the Metropolitan Water Board. The Board now directs the largest water supply undertaking in the world and has an annual revenue of over £7,000,000 ($28,000,000). Its members are elected from the local government authorities in the area of supply. Since it began many large works supplying water of improved quality have been constructed or remodelled to meet an ever-increasing demand. This work has gone on despite World Wars I and II. In World War II considerable damage resulted from air raids.

Space does not allow a full description of the Board's activities today, but a brief note will assist in an appreciation of the work and responsibilities involved in providing 6,300,000 persons over an area of 540 square miles with drinking water at an average daily consumption of 32 gallons a head.

River water is abstracted from the Thames and Lee in the proportion of two-thirds and one-sixth of the total supply. The remaining one-sixth is pumped from wells.

Large Storage Reservoirs Important

In general the polluted river supplies pass into large storage reservoirs which possess a total capacity of nearly 18,000,000,000 gallons—an impressive figure. They extend over large areas in the two river valleys on the outskirts of London.

After several weeks in one of these reservoirs a vastly improved water flows to a filtration works. Here the water passes by gravity through a bed of coarse sand, termed a rapid filter, at a vertical rate of about 220 inches an hour. During this process larger particles in suspension are removed, but little bacterial improvement takes place. The water next passes on to open slow sand-beds having about two feet six inches of fine sand as the filtering medium. As the water passes through this bed by gravity at a rate of about eight inches an hour the microscopic bacteria are normally retained in the important living layer which rapidly forms on the sand surface and in the sand immediately below. The filtrate from these large beds, each some half to one acre extent, is of good quality, but as a final important safeguard a very small quantity of chlorine is introduced as a sterilizing agent, the dose being usually about 0.8 parts per million by weight of the filtered water, with the addition of ammonia at quarter this dose to prevent chlorinous taste.

After this fourfold treatment the water flows to the pumps. In the case of well waters the supply normally only requires chemical treatment.

Pumping

The pumping machinery includes a great variety of types, from rotative beam steam units with plunger pumps which have run with great reliability for many years, to the most modern turbine units driving centrifugal pumps operated at low running cost. Increasing use is now being made of power purchased from the electricity undertakings with diesel engine alternators as standby in the event of power failure.

Completely dependent on pumping for maintenance of the supply, London's water is often passed through two or three pumping stations before it reaches the consumer. The magnitude of these duties can be gauged from the fact that the annual consumption of coal alone is over 150,000 tons.

Distribution

There are 8,305 miles of cast iron and steel mains, varying in size from two inches to 78 inches in diameter, through which the water passes to the public. To assist in the distribution under conditions of fluctuating demand and as an insurance against temporary main or pumping failure, there are many covered reservoirs on high ground which receive filtered water from the pumps and supply the area in the vicinity by gravity.

To ensure the purity of the water, samples are taken daily from many parts of the distribution system, and at works before and after treatment. These samples are subjected to bacteriological, chemical and biological tests at the Board's laboratory. Upwards of 60,000 samples are examined annually.

The multifarious tasks involved in maintaining such a supply are carried out by a staff of 6,200 officers and employees. And as a result of constant vigilance by all concerned, no case of typhoid fever definitely attributable to the water supply has occurred since London's Metropolitan Water Board began more than 55 years ago.

*Deputy Supply Engineer of London's Metropolitan Water Board

W. W. Eckenfelder Opens Consulting Office

W. W. Eckenfelder, Jr., has announced the formation of a consulting laboratory called Eckenfelder Associates, Inc., Sanitary Chemists.

Located at 201 East Ridgewood Ave., Ridgewood, N.J., Mr. Eckenfelder's new consulting office will offer services for sewage and industrial waste surveys, process and research development, water analysis, stream pollution investigation, laboratory analyses and reports.

Mr. Eckenfelder is known to readers of *Water & Sewage Works* magazine as the co-author of a series of articles on the fundamentals on the chemistry of sewage treatment now appearing under the authorship of Mr. Eckenfelder and J. W. Hood, Supt. of Sewage Treatment at Ridgewood, N.J.

And—It's Just a Drop in the Bucket

The steel industry spends about $10,000,000 annually to keep clean the streams and rivers it uses, the American Iron and Steel Institute reports. In addition the industry has more than $10,000,000 invested in equipment to purify its major waste liquid, "used pickle liquor," which is the acid bath used to remove oxide scale from certain steel products.

NEWWA 69th ANNUAL CONVENTION

Poland Spring Meeting Draws 525

MEETING once more at famed Poland Spring House in Poland Spring, Me., the New England Water Works Assn. held its 69th annual meeting. Five hundred and eighteen persons including 165 active members, 148 associate members representing 66 companies, and 205 guests (34 men and 171 ladies)

Presidents

Incoming	Outgoing
Thos. R. Camp	*Sidney S. Anthony*
Cons. Engr.	*Supt. of Water*
Boston, Mass.	*Augusta, Me.*

registered for the meeting. Beautiful weather, delightful meals, competitive golf, pleasant conversation, attractive manufacturers exhibits, and interesting technical papers added up to make this a thoroughly successful meeting.

New Officers

Elected to serve as officers for the ensuing year were the following:

President

Thos. R. Camp, Cons. Engr.
Camp, Dresser & McKee
Boston, Mass.

Vice Presidents

Frederick O. A. Almquist
Prin. San. Engr.
Conn. Dept. of Health
Hartford, Conn.

Stanley M. Dore
Asst. Ch. Engineer
Allegheny Co. San. Authority
Pittsburgh, Pa.

Directors

William B. Duffy, Supt.
Public Works Dept.
North Andover, Mass.

Roger G. Oakman, Supt.
Water Division
Needham, Mass.

Allan F. McAlary, Supt.
Camden-Rockland Water Co.
Rockland, Me.

Treasurer

William P. Melley, Supt.
Water Dept.
Milton, Mass.

Secretary

Jos. C. Knox, Chief Engr.
N.E. Interstate Compact Comm.
Boston, Mass.

Editor of Journal

George C. Houser
Brookline, Mass.

Awards and Honors

This year the annual dinner at which the active members were the guests of the Water & Sewage Works Manufacturers Assn. was held on Wednesday night and closed the meeting. Awards and honors were presented following the dinner and preceding the entertainment and dancing.

Horace L. Clark, Cons. Engr., Alfred, Me., and Chairman of the Dexter Bracket Award Committee made the presentation of the DEXTER BRACKET MEDAL to Samuel Jacobsen and Marshall S. Wellington, respectively, Chemist and San. Engr. of the New Haven, Conn. Water Co., for their paper titled "Introduction of Prechlorination of Slow Sand Filters."

The COMMEMORATIVE AWARD was made this year in the name of the late Francis C. Dean, onetime consulting engineer of Boston, and authority on pumps and pumping. President S. S. Anthony, Supt. of Water, Augusta, Me., made the presentation of the award to Clarence L. Ahlgren, Manchester Water Works, Manchester, N.H., for his paper titled "Diesel Pumping Unit for Manchester Water Works."

President Anthony also made the presentation of Twenty-Five Year Awards to B. Lewis Covell, Supt., Warren Water Works, Warren, Mass.; Charles G. Fuller, Mgr., Water, Sewer and Electric Dept., Wellesley, Mass.; and Samuel G. Wylie, Water Dept., Webster, Mass. This award is made to those persons who have been members of the NEWWA for 25 years and who have served the same municipality for the same number of years.

Business Session

The opening session was devoted to the annual business meeting at which reports were presented by the Secretary, Treasurer, Editor, and chairman of the Legislative Committee, Finance Committee, and Committee on Committees as well as the chairmen of various committees.

Vice Presidents

Senior	Junior
Fred O. A. Almquist	*Stanley M. Dore*
State Dept. Hlth.	*Asst. Ch. Engr.*
Hartford, Conn.	*Allegheny Co. San. Auth.*
	Pittsburgh, Pa.

Of interest was the fact that the membership declined by one in spite of a goodly number of new members. It was pointed out that unless membership in the Association increased, dues might have to be increased from 6 to 8 dollars, but this increase is not contemplated unless the membership continues to remain static.

Following discussion of the Standard Specifications for Cold-Water Meters — Current Type, Propeller Driven, the association voted to accept the standards and the committee was discharged.

The committee on water shortage reported that in the six New England States, there are 38 shortages in water supply and 7 in distribution systems. The greatest deficiency of supply is in Rhode Island and north and eastern Massachusetts.

Ground water levels are lower in many areas than ever before and many of the cities which are short in supply are those which have ground

Outdoor Demonstrations

water supplies. The report observed that whereas in early days the old English law of quasi-riparian rights applied, this doctrine is now passing out of existence and the doctrine of reasonable use is taking its place.

T. R. CAMP, Cons. Engr. of Boston asked what was happening in the study of jointing compounds. Linn H. Enslow, Editor, *Water & Sewage Works* and past president of AWWA, reported that the studies made by the Arthur D. Little Co. had been inconclusive, largely because it had not been possible to obtain representative samples from a wide enough distribution. The AWWA has set up a fund and has employed the Black Laboratories of Gainesville, Fla., to make a thorough study of the problem which has presented many baffling aspects. Several persons expressed the opinion that if the compounds were put in correctly, it would not fail.

The Committee on Committees reported that during the year, joint committees had been appointed on Fluid Permeability and on Deep-Well Vertical Pumps. It recommended that in view of the rapidly changing world situation, the Executive Committee should give consideration to the appointment of two committees, one of which might be designated as a Committee on Defense Measures, and the other as a Committee on Deferments or Priorities.

The Committee on Committees also reiterated its belief that a program of public education should be established through paid expert service or in some other way. This is the third time the Committee has recommended some consideration of the idea.

Humor Patented

In a highly amusing illustrated lecture on "HUMOR PATENTED," Charles G. Richardson, Vice President, Builders-Providence, Inc., Providence, R.I. showed a very appreciative audience a number of the "funny" devices for which patents had actually been granted by the U.S. Patent office. Not the least amusing of the presentation were some of the actual claims made by the inventors. Such "crazy" ideas included balloons powered by eagles, devices whereby trains can run over one another, devices for moulding the female shape, and sewing machines operated by talking into them.

New England Dams

"NEW ENGLAND DAMS AND OUR WATER RESOURCES" by Richard Martin, Director, Connecticut State Water Commission, Hartford, Conn.

Mr. Martin gave a thoroughly comprehensive review of the history of dams in New England and pointed out that dams for grist mills, and saw mills were important in the development of New England. Development of factories came with the development of water power through dams.

Secretary
Joe. C. Knox
Exec. Dir.
N.E.I. Compact
Boston, Mass.

Treasurer
Wm. P. Melley
Supt.
Water Dept.
Milton, Mass.

Mr. Martin also reviewed the types of dams which were native to early New England and the types of water wheels which were used in producing power before electricity came in.

Many of the present day reservoirs are located on the sites of lakes dammed a hundred twenty-five years ago. Many of the present dams today are quite high and produce some very large reservoirs. In addition, there are many flood control dams in New England; eight of these exist in Connecticut alone.

According to Mr. Martin, New England has plenty of water for its needs but there are water works management problems peculiar to the area. One big problem is to rebuild old reservoirs on the sites of old power dams as a redevelopment program for new uses with new methods. Some of these problems can be solved by viewing the future in light of the past.

Peak Demand Loads

"PEAK WATER DEMAND LOADS IN WATER SUPPLY SYSTEMS" by William E. Stanley, Prof. of Sanitary Engineering, Mass. Inst. of Tech., Cambridge, Mass.

Prof. Stanley said that the term peak demand loads has not been as commonly used in the water supply field as in other utility fields. More extended use may be expected in the future as more rate schedules come into vogue with rates of charge based on "peak demand loads." Otherwise there may be confusion between peak rates of water usage and rates of charge for peak demand loads in the water supply system.

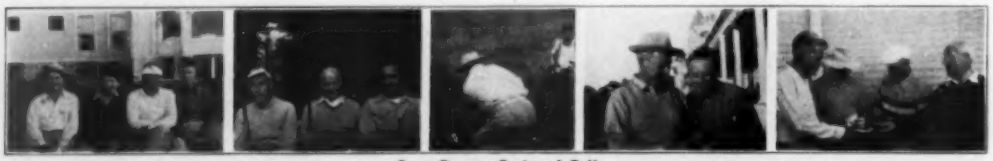
Prof. Stanley made his studies on three water supply systems, Quincy, Taunton, and Belmont, Mass. As a base for comparison Prof. Stanley took the yearly average water demand computed from total volume supplied to users divided by 365 or 366 days.

It was found useful to classify fluctuations in water demand as (1) seasonal, (2) daily, (3) hourly, and (4) sporadic variations. The latter variations occur with no regularity and may be due to fires or other causes.

Prof. Stanley reported the results of studying these several variations for the three cities. Seasonal variations were easy to spot, but data on daily variations are not easy to collect and more difficult to place on a mathematical probability basis. Frequent increases due to fires make daily data hard to obtain. Such data show that the lowest pumpage occurs on Sunday and the highest on Wednesday, but there is little to be gained in the analysis of average pumpage according to the days of the week.

Patterns of charts illustrating hourly variations in water demand are similar with respect to the hours of low demand and high demand. And this pattern holds for winter as well as summer.

Prof. Stanley pointed out that water demand-duration curves have not been commonly used in water works engineering problems, but he believes that such curves could be quite useful in connection with the solution of many water works problems and would become important analytical aids should



Some Persons Preferred Golf

(First Tee — Resting — Roy Evans in Trouble — Adding up Score — Somebody Wins)

water service rates as related to water demand loads become a more common practice.

In closing, the speaker said that many water works departments are not equipped or organized to obtain proper data from which water demand-duration curves might be prepared. Accurate recording of water rate of flow metering equipment is required together with an operating routine of labelling, collecting, and filing the meter charts.

Committee Chairmen

Ladies Program	Dexter Brackett
Mrs. H. L. Clark	*Horace L. Clark*
Alfred, Me.	*Cons. Engr.*
	Alfred, Me.

WATER METER SYMPOSIUM

As a feature of the Superintendents' Round Table, a Symposium on Water Meters was held under the leadership of WILLIAM B. DUFFY, Supt., Board of Public Works, North Andover, Mass. The discussion included manufacture, testing, and setting of meters.

Participating in the panel discussion were John and Richard Ford, both of the Ford Meter Box Co., Wabash, Ind.; Jens I. Duus, Fact. Supt., Nat. Meter Div., Rockwell Mfg. Co., Brooklyn, N.Y.; and Chas. Bachman of the Neptune Meter Co.

Manufacture of Meters

"MANUFACTURE OF WATER METERS" was the topic covered by Jens I. Duus of the National Water Meter Div. Mr. Duus reviewed the history of metering and pointed out that the earliest meter was the current type. Next came the principle of the oscillating piston. The original application of this idea was to the steam engine. Last came the nutating disk, which was first applied to the water wheel and then to the steam engine. The idea was adapted to water meters in the decade prior to 1900 by such men as Gamon, Nash, and Thompson.

As a part of his paper, Mr. Duus traced the manufacture of water meters from the beginning in the brass foundry through pattern molds, then to the machine shop where half of the parts are machined to 1/10,000 of an inch. Where hard rubber is used, the piston or disk must be machined to even closer tolerance.

According to the speaker, the gear train must operate freely and smoothly and the register is a very important part of the meter. Testing of the equipment is highly important.

One of the many changes made in the past 25 years has been the consolidation of meter companies. There are only half as many manufacturers now as there were in 1926. Specifications of performance have greatly improved and manufacturers have kept ahead of AWWA Specifications. Uniformity of change gears has become standard. Powdered metal and stainless steel have found many applications.

Meter Setting

RICHARD V. FORD, Vice Pres. of Ford Meter Box Co. and Eastern Representative, Philadelphia, Pa., spoke about "Inside Meter Setting." He pointed out that the meter may be the only personal contact a consumer has with the company or water department. It is important to set a meter properly. A poor job of setting is the most expensive that can be done.

Mr. Ford said there are many problems to meter setting: The service line may be good, bad, or indifferent; while the best place for the meter is at the front wall 2 to 4 ft. above the floor, such things as coal bins and fruit storage may make it impossible to so place.

Meters should be set horizontally, and put above the valve. If the pipe is old, use a packed type joint; if the valve leaks or needs to be changed, don't dig up the service line, use the dry ice freezing technic, to reduce the water flow or stop it. Then cut out the valve and replace it.

Mr. Ford closed with the admonition that water superintendents should always see that a top grade job is done, otherwise the water department will be blamed for any trouble that may come up regardless of its cause. As to the cost of meter installation, Richard Ford said that at Freeport, L.I., an installation of some 5000 meters, the cost of setting was $5.00 for material and labor exclusive of the cost of the meter. In New York City the cost was $16 per installation.

JOHN FORD, Vice President and Treasurer, Ford Meter Box Co., Wabash, Ind., spoke on "Outside Meter Setting." In most locations south of the Ohio River and in many places in the west, meter settings are made outside. There are many advantages to outside setting, but in cold climates such settings are not too good. Indications are that about 5 per cent of the meter installations in Portland, Me., are at the curb.

Immediate Past-Pres.	Program Chairman
Arthur C. King	*Truman Safford*
Supt. of Water	*Chas. T. Main Engrs.*
Taunton, Mass.	*Boston, Mass.*

Among the reasons for the outside setting of meters are: (1) No basements, (2) distance from house to street, (3) branched services, (4) summer homes which are closed in the winter, (5) inability to get into house because resident is away, and (6) if the service line between the curb and the house goes bad, the customer is likely to repair it because he has to pay for the wasted water.

If outside settings are used, Mr. Ford warned that water departments should not be lulled into disregard for trouble by a mild winter. He suggested using the degree day record to keep watch of conditions. Frost penetration data are also important. Outside settings must be designed for type of soil as well as average temperature of the locality.

Testing of Meters

CHARLES BACHMAN, Neptune Meter Co., spoke on testing of meters. He called attention to the meter specifications of 1921 wherein testing at set

Still Others Preferred Putting

(Two W&SW Boys *She's Good* *Steady There* *Watch This* *New Arrival)*

rates of flow was sanctioned. Later there followed multiple testing units. There is still a controversy as to the number of flows at which meters should be tested. Mr. Bachman suggests testing at high, low, and average rates. Two-inch meters should be tested in place. Meters above 3-in. should be tested once each year.

In the Question and Answer Period which followed, W. W. Brush, Editor, *Water Works Engineering*, New York City, asked which type of soil settings. R. V. Ford answered that the Amer. Water Works Co. of Philadelphia was using battery settings in place of compound meters. Mr. Ford also remarked that in deciding when, where, and how meters should be tested, the utility should be guided by the cost of water, the cost of repairs in the shop, the amount of water sold, and how fast the meter is running down hill.

JENS I. DUUS said that the trend now is to compound meters and multi-service type meters the friction loss is only 4 psi. Such a low loss is hard to achieve with a battery of disk meters. Clearances in disk meters is so close that at high rates of flow, rust or other foreign matter which might be flushed into the meter is a hazard.

Dexter Brackett Award

Marshall Wellington
San. Eng.
New Haven Water Co.
New Haven, Conn.

Sam. Jacobsen
Chemist

Commemorative Award

C. L. Ahlgren
Engineer
Manchester, N. H.

was best for outside setting. JOHN FORD replied that clay and loam are better insulators, and that the experiments of Harry Fuller at Portland indicated that frost penetration was fastest in gravel.

RICHARD FORD told of the experience of the City of Baltimore in 1936. It was found there, that the causes of outside meter freezing were in order: soil filled curb boxes; poor installations with the riser pipes touching or nearly touching the wall of the box, and leaking covers.

ROLLO BLANCHARD, Vice Pres., Neptune Meter Co., invited water works men to visit a meter manufacturing plant to see how the "cash register" of the industry is manufactured. He called attention to the fact that as yet no priorities have been set up in the water works industry but that escalator clauses are going into contracts, just in case they are needed.

The Panel Leader, WM. DUFFY asked if there is a trend to battery ple settings with the latter used for anything over two inches. RICHARD ELLIS of Factory Mutual Ins. Co. said there had been an increase in fire service type meters in industrial type installations.

HAROLD GRISWOLD, retired Manager at Hartford Co., asked how large a utility should be to have its own repair shop. JOHN FORD said that no utility was too small, but the amount of repair done in a shop should depend on facilities available, but he cautioned that an ingenious operator is essential. There is a growth of meter repair companies, however, indicating that for smaller cities, it may be preferable to farm out the repairs.

SHERMAN ROGERS, Supt. of Dist. Hartford, Conn., asked if the Fire Underwriters Assn. would approve multiple disk type meters on private fire protection. Mr. Ellis of Factory Mutual replied that it was essential in such a consideration to balance the battery against friction loss. For fire

Construction Equipment Operation

"THE COST OF OPERATING CONSTRUCTION EQUIPMENT" by Sherman L. Rogers, Supt. of Distribution, The Water Bureau, Metropolitan District, Hartford, Conn.

Before World War II, Hartford hired equipment needed for installation of mains, etc. Now the department buys and uses its own equipment. They first bought a ½ cu. yd. back hoe, then followed a portable ½ cu. yd. back hoe, and that was followed by a ¼ cu. yd. bucket on a ¾ cu. yd. tractor tread machine. Next came a Link-Belt Crane Truck to unload pipe and that was followed by two Hough Payloaders.

Mr. Rogers showed tables of costs per year. By the use of hour meters it was possible to actually calculate the cost of operation. Whereas the cost of operation varied from $3.31 to $6.00 per day, the cost of rental is $6 to $10 a day, but it must be remembered that many times in the rental of machines, payment is on the basis of hours on the job whether or not the equipment is actually working. Depreciation is based on a five year cycle. The Hartford Water Utility also has air compressors mounted on trucks and prefers those which are not driven by power take-offs. Compressor cost of operation is from $0.85 to $1.48 per hour. Mr. Rogers concluded that it was both better and less costly for a water utility to own its own construction equipment.

Cone Values

"PRESENT DAY USES OF CONE TYPE VALVES" by Carl J. Wilcox, Engineering Manager, Valve Division, S. Morgan Smith Co., York, Pa.

According to Mr. Wilcox, rotary plug valves have been used since an-

Humor
C. G. Richardson
Vice Pres.
Builders-Providence
Providence, R.I.

Dams
Rich. Martin
Director
Conn. Wat. Comm.
Hartford, Conn.

Peak Loads
Wm. E. Stanley
Prof.
Mass. Inst. Tech.
Cambridge, Mass.

Equipment
Sherm. Rogers
Supt. Distr.
Water Util.
Hartford, Conn.

Dam Repair
E. L. Hopkins
Engineer
Kennebec Power
Waterville, Me.

Program Participants

tiquity but it is only in the past 25 years that the modern precision rotary plug valve has been used for shut-off and control valve service on water distribution and other services. It is known as the cone valve and has three distinct advantages; (1) Ease of operation, (2) Tightness when seated, and (3) Throttling characteristics which give advantageous flow control, plus long life due to appreciably slight wear.

There are two types of cone valves on the market: those which move axially to unseat before rotation, and those which have no axial movement. Mr. Wilcox confined his remarks to the first of these two types since the latter has not been used to any extent in the water works industry.

Cone valves are classified in two categories—Full area round ports and reduced area venturi pattern with trapezoidal plug ports. The latter is more recent and is designed for a specific function, namely as a shut off valve.

Full opening valves are divided into manualy operated and mechanically operated valves. The former are used in pipe line and distribution work. The latter have a multitude of uses according to Mr. Wilcox, who also outlined more or less in detail the various applications of cone valves in the water works field.

Watershed Protection

"SANITARY PROTECTION OF WATERSHEDS—ARE WE OVERDOING IT OR UNDERDOING IT?", by Arthur D. Weston, Cons. San. Engr., Charles A. Maguire & Assoc., Boston, Mass.

Mr. Weston called attention to the fact that whether we like it or not, it is no longer possible to obtain virgin watersheds. Water utilities must face the reality of pollution sources on watershed areas.

While a reasonable amount of protection is necessary, it may be that the value of protection will decrease, because a utility can get more for its money by putting it in other phases of water treatment. In short, in the future the cost of water purification may be cheaper and more effective than watershed protection. With the increase in population and the tendency for population to spread out into the country, especially in the summer months, this thesis would appear to be well founded. Mr. Weston cited the state of Massachusetts to emphasize the thought he had expressed.

A prepared discussion by WARREN SCOTT, Director, Bureau of Sanitary Engineering, Connecticut State Health Dept., Hartford, Conn., was read by F. O. A. ALMQUIST, Prin. San. Engr. of the department. Mr. Scott's paper was confined largely to a discussion of conditions in Connecticut. Here too, real estate development and population shift have added to the problems of watershed protection. He suggests interconnection of metropolitan water supplies to obviate the need for small systems, and continuation of sewage treatment on fairly clean streams because they might be needed for water supply. While Mr. Scott does not believe that watershed protection is being overdone, he does think that we must re-evaluate the approach to the subject and that if regulations are relaxed, then water treatment must be added as a safeguard.

HAROLD B. SCALES, Chemist, Portland, Water District, Portland, Me., presented the second prepared discussion and confined his remarks to the State of Maine, with particular reference to Portland. He pointed out that the density of poulation in Maine was only 30 per sq. mi. or 63 per sq. mi. in the summer when the tourists were counted. Even figuring that most of the population is in the southern part of the state, there are only 90 persons per sq. mi. at the most. Thus Maine does not have the problem that more densely populated areas have. Mr. Scales said that as to overdoing or underdoing watershed protection, it is a matter of the individual supply how much or how little should be done.

Speaking for the State of Vermont, EDW. L. TRACY, State Sanitary Engineer, said that a balance was needed between watershed protection and treatment. It is impossible to obtain perfect protection and there is always the problem of animal pollution to plague the interpretation of analytical results.

National Water Policy

"THE ENGINEERING PROFESSION VOICES ITS OPINION ON A NATIONAL WATER POLICY" by Linn H. Enslow, Coordinator, E.J.C. Water Policy Panel, and Editor of *Water & Sewage Works*, New York City.

Mr. Enslow's talk presented the highlights of a forthright statement addressed to the President's Water

President
R. F. Hayes
Vice Pres.
Hydrotite Corp.
New York City

Manufacturers Association
Act. Secy.-Man.
Miss D. E. Dimmers
WSWMA
New York,
N. Y.

Vice President
R. F. Orth
Mgr.
"Transiste"
New York City

More Programmers

Water Shed Protection

A. D. Weston
Cons. Engr.
C. T. McGuire Co.
Boston,
Mass.

W. J. Scott
Director
San. Engr. Div.
Conn. H'lth Dept.
Hartford, Conn.

H. B. Scales
Chemist
Portland Wat. Dist.
Portland, Me.

Edw. L. Tracy
Director
San. Engr. Div.
Vt. H'lth Dept
Burlington, Vt.

Water Policy

L. H. Enslow
Editor
Wat. & Sew. Wks.
New York City

So. Amer. Water

C. L. Sterling
Director
San. Eng. Div.
Mass. H'lth Dept.
Boston, Mass.

Resources Policy Commission and the Congress of the United States, by the Water Policy Panel of the Engineers Joint Council.

Mr. Enslow paid tribute to the 75 engineers who participated in the preparation of the report and he pointed out how remarkable a job had been done in less than five months. Furthermore, it was a noteworthy report in that no minority report was submitted. The complete unanimity of these engineers in arriving at the ideas contained in the report should be gratifying to the entire water works industry.

Mr. Enslow explained how the Engineers Joint Council is composed of representatives of the five Founder Societies, ASCE, ASMME, ASME, AIEE, and AICHE. Although not directly represented, the AWWA, the NEWWA and the FSWA were adequately represented by various members on the panel Committees. The Coordinating Committee was chairmaned by Abel Wolman, a Past President of AWWA, and the Task Committee on Domestic and Industrial Water Supply and Pollution was headed by Louis R. Howson, a Past President of AWWA, and L. H. Enslow, also a Past President of AWWA, was contact member for this Task Committee.

There were nine task committees; the other eight in addition to that mentioned above were, Flood Control, Navigation, Irrigation, Hydroelectric Power, Recreation, Basic Water Resource Information, Land Drainage, and Policies and General Applicability.

The completed report contains not only the Statement of the Coordinating Committee but also eleven appendixes covering the reports of the various task committees. Mr. Enslow quoted excerpts from various recommendations and conclusions of the Overall Statement and concluded with the reading of the general conclusions of the Task Committee No. 1, on Domestic and Industrial Supply and Pollution. These are the Conclusions of that Task Committee:

A—The use of water resources for domestic and industrial purposes is believed to be the highest and best use. Without adequate water supply properly safeguarded against pollution, urban life cannot exist.

B—The use of water resources for domestic and industrial purposes is also the only universally distributed use. In this respect it is unlike irrigation or hydroelectric or flood detention which are limited in area of development.

C—Although nation-wide in development, domestic and industrial water supply present essentially local community problems. Of the 13,000 public water supply systems serving 85,000,000 people in the United States with approximately 15,000,000,000 gallons of water per day nearly all are intrastate. Only a few have interstate problems and a very limited number are concerned with more than two states.

D—Urban or private industrial water supplies should accordingly be built and paid for by those using the service. The cost of water from public supplies, which is usually less than 2c per capita per day, is within the economic reach of all.

E—Since the domestic and industrial water supplies are of such prime importance it necessarily follows that pollution of water resources must be so controlled as to make it practicable to provide a water of satisfactory quality as well as adequate in quantity.

F—Pollution of water should be regulated at the lowest governmental level adequate for the particular situation. Some will be wholly local, some at state level and some at state compact level. Federal jurisdiction and participation should be limited to the administration of existing laws; to research, investigation and guidance upon which sound state laws and local regulations may be based, with as much uniformity as is consistent under the variable conditions encountered.

G—On dual or multi-purpose projects involving public water supply, the local community should pay its fair proportion of the cost and the project only then be carried forward if the remaining part of the cost to be provided from federal funds has a proper cost-benefit ratio.

Symposium on Water Meters

Leader	Outside Setting	Inside Setting	Manufacture
Wm. R. Duffy	*John L. Ford*	*R. V. Ford*	*Jens I. Duus*
Supt.	*Treas.*	*Vice Pres.*	*Asst. Supt.*
Bd. Pub. Wks.	*Ford Meter Box Co.*	*Ford Meter Box Co.*	*National Meter Div.*
N. Andover, Mass.	*Wabash, Ind.*	*Philadelphia, Pa.*	*Brooklyn, N. Y.*

Programmers

J. E. Revelle	*C. S. Wilcox*
Contr. Engr.	*Engr.-Mgr.*
Chi. Bridge & Iron	*S. Morgan Smith Co.*
Boston, Mass.	*York, Pa.*

Dam Repair and Maintenance

"The Maintenance and Repair of Dams and Other Hydraulic Structures" by Bryant L. Hopkins, Engineer, Kennebec Water Power Co., Waterville, Me.

Mr. Hopkins confined his remarks to concrete dams, pointing out that wooden dams have mostly been replaced in the past fifteen years, and that in spite of the fact that old stone dams set in sulfur have lasted a lifetime, no one is building them anymore.

A number of slides were shown to illustrate the type of damage that can and does occur and how it can be repaired. There is no reason to believe that it is the cement itself which is deteriorating but rather it is the improper mixture of cement and aggregate. It is important to regulate seepage and to prevent frost damage, and this done, there will be less maintenance needed.

South American Water Supply

"Water Supply Developments in the Other American Republics" by Clarence I. Sterling, Jr., Chief Sanitary Engineer, Massachusetts Dept. of Health, Boston, Mass.

Each of the other 20 republics in the Americas have individual problems. They are themselves as individual as possible and the water supplies vary as does everything else, character of people, character of business, and so forth.

In the Latin American countries, temperatures vary from tropic to temperate, there are mountains and valleys, and precipitation ranges from practically nothing to 120 inches per year. It is not possible therefore to generalize about water supply in South and Central America.

Mr. Sterling who had travelled extensively in these countries while he was attached to the USPHS and the Pan American Sanitary Bureau, called attention to the problems of earthquakes, the large amount of water lost through leaky distribution systems and the small per capita consumption.

While there are good engineers in these countries most of them are attached to the national government because only the government can operate the water facilities. Prior to World War II, most equipment for water supply came from Europe, but now U.S. equipment is moving into these countries. The shortage of U.S. dol-

lars does more to impede this movement than any other factor.

Elevated Tank Construction

"THE CONSTRUCTION OF SPHERICAL AND RADIAL CONE ELEVATED WATER TANKS" by J. Edgar Revelle, Contracting Engineer, Chicago Bridge and Iron Co., Boston, Mass.

Mr. Revelle spoke first on the construction features of these two types of tanks and then presented two motion picures showing actual construction of both types of tanks.

Entertainment

A cocktail party preceded the annual banquet, both of which were furnished by the members of the Water and Sewage Works Manufacturers Assn. Entertainment was also furnished on all three nights, with Tuesday night being reserved for a "Barn Dance." Dancing was also held on the other two nights. Golf and Putting Contests were also featured with appropriate prizes for winners. Chairman of the Entertainment Committee was William P. Brenchick, Johns-Manville Sales Corp., Boston, Mass. Reginald F. Hayes, Vice Pres. Hydraulic Development Co., New York City, represented the WSWMA as President.

Here and There

Gerry (A. P. Smith) Manahan standing left — *Hats for the Men—Bonnets for the Ladies* — *Three good men—John Ford, Bill Duffy and Sherm. Rogers*

Lloyd Clark Joins Cons. Engrs. in Oregon

The firm of Clark and Groff, Cons. Engrs., Salem, Ore., has announced the addition to the firm of Lloyd K. Clark, Sanitary Engineer. The firm was formerly known as Groff and Clark, and consisted of Gilbert Groff,

Chemist and Sanitary Engineer, and Warren W. Clark, Civil Engr.

Mr. Lloyd K. Clark has recently completed a four year sanitation research and development project for the Assoc. of Amer. Railroads, at Baltimore, Md. He is a former State Sanitary Engineer of North Dakota and during World War II served at the 7th Serv. Command Hdq. at Omaha, the Office of Surgeon General in Washington, D.C., and in New Guinea and the Philippines. He is a graduate of North Dakota State College and M.I.T. with additional graduate study at Cornell University.

The reorganized firm with offices located at 3245 So. Commercial St., Salem, Ore., will specialize in municipal and sanitary engineering with particular reference to stream pollution and industrial waste treatment.

20-Year Index for Sewage Works Journal

The 20-Year Index to *Sewage Works Journal*, covering Vols. 1-20, 1928-1948, incl., is now available through the Fed. Sew. Wks. Assns. The 20-Year Index covers 115 volumes containing 22,000 pages. The Index is composed of three main sections with listing by author, subject, and geographical location. Entries are provided for the entire content of the *Journal*, including original papers, editorials, committee reports, abstracts, Federation affairs, and even fillers.

According to the advance notice issued on the Index, "especial attention has been given to the emphasis of key words and to cross-indexing. Several unorthodox ideas have been incorporated in this index, while some time honored conventions have been sacrificed in the interests of maximum facility. The compilers accept full responsibility for these deviations from conventional practice, with the conviction that the final product has been enhanced thereby."

The 20-Year Index was compiled by W. H. Wisely, Executive Secretary, Fed. Sew. Wks. Assns. and Editor of *Sewage Works Journal* since 1944, and Dr. George E. Symons, Managing Editor of *Water and Sewage Works*.

The index contains more than 9000 entries gathered by a page-by-page search followed by a complete check in the course of final assembly. In most cases the original wording of titles was replaced by a shorter more specific statement of actual content of the article. Details of format and style were adopted with the idea of serviceability in mind. Bold face type and indentation are judiciously used to assist the searcher and a unique provision is the dictionary form of running head in which the first and last entry on each page is indicated.

The Index contains 144 pages (6¾ by 10 in.) and is bound in buckram. It is published for the Federation by The Gerrard Press, Champaign, Ill., and retails for $4.50 per copy. Orders may be placed directly with the publisher or with the Federation.

Colonel Rich is Dead

For 33 Years Chief Engineer of Michigan Dept. of Health

Edward Dunbar Rich, former Director, Division of Engineering, Michigan State Dept. of Health, died on Sept. 29, 1950, at his home in Lansing, Mich. He was 81 years old.

Colonel Rich, who served in World War I, was the first and only State Sanitary Engineer of Michigan from the time of his appointment as such in 1913, to his retirement in 1946. A native of New York state and graduate of Renssellaer Polytechnic Institute, Col. Rich served as consultant to the Michigan Health Dept., even before the creation of the position of State Sanitary Engr., in 1913.

Colonel Rich was an outstanding executive and developed a staff of exceptional younger engineers under him. In him, all concerned had the greatest of confidence of engineering ability, combined with fair dealing toward everyone with whom he dealt. Upon his retirement the Michigan section of the American Water Works Assn., established a tenure of service award known as the Edward Dunbar Rich Award, which stands now in his memory.

Colonel Rich is survived by his widow and one son, Edward D. Rich, Jr.

OPERATION OF SMALL WATER WORKS

What About the Manager?

by

A. E. CLARK

Manager

Nashville Suburban Utility District

NASHVILLE, TENN.

WATER-WORKS publications carry many articles written by the personnel of Water Departments, including superintendents and managers, covering a variety of subjects from rate structures to all the various phases of operation. Relatively few are written about the managers themselves, other than special duties which are ordinarily delegated to him. Is this because the assumption is made that he knows all the answers pertaining to all the operations of the water system? If this is true the writer, after taking stock of himself, finds that he is sadly lacking due to the fact that something new comes up quite frequently for which he does not have an answer and has to scurry around and get one. It may be of a legal nature or a somewhat involved engineering problem or public relations. To whom does the manager go to get information of this nature? What outside services are available to the manager of a small water-works?

Ever See a Specification for a Small Water-Works Manager?

What are the qualifications required in a manager of a small water-works? Obviously they would vary little from those required in the larger water-works, with this exception, he is required to carry out many duties which the manager of the large water-works usually delegates to others. He should have executive and administrative ability because all matters under these two headings fall directly on him. He must have some knowledge of personnel work as he usually employs and terminates employment, and it is to his advantage to secure proper personnel for the various duties under his direction. Purchasing of materials is a rather large item of responsibility and business acumen in the operation of any water system. Purchase of materials of the type and kind best suited to the work or application requires some experience with water-works materials as well as the different operations in the field. Some knowledge of bookkeeping and accounting, office management, rate structures and records is an essential, since the operation of any business, whether it is a public utility or private enterprise, requires this of the manager for its success. Field operations will not take care of themselves; therefore, it falls to the lot of the manager to keep in close touch with this work and he should be entirely familiar with all work going on as well as giving thought and study to betterments and extensions to the system as required.

The Author

Policy Making

Depending on the set up of the water system, the policy making body may be the members of a city council, a commission or board of directors. Regardless of the type of policy making body the recommendations of the manager usually to a major extent determines any action taken. A policy, once established, is difficult to change; therefore, before making any move toward changing a policy or setting up new policies it should be determined that these are sound and workable. Too many times policies have been adopted and when applied it has been found that exceptions had to be made. As a rule policies of a broad nature, which allow some latitude and depend somewhat on the judgement of the manager, are the safest and most satisfactory policies. Of course, this could be carried too far, but the policy making body is usually composed of men competent to judge the rules and regulations which they adopt. Once a policy or regulation has been adopted it should apply equally to *all* consumers in the class for which it was made.

Legal Guidance Important

Questions of a legal nature arise quite frequently. As a rule, unless the manager has a good legal background these questions must be referred to an attorney. Municipal water departments have available the guidance of the City Attorney. Other water-works have to make some arrangement to get the needed advice from an attorney who is employed on a retainer or fee basis. A public utility is usually a target for many who think they have basis for a lawsuit which might be the means of extracting money from them. Too many people have the mistaken opinion that all utilities are rich. It is too bad that these people do not have the opportunity to manage some of the smaller water-works, because their opinions would undergo a great change.

Small Office Personnel Must Know All of the Answers

Small offices may be somewhat more difficult to operate than large ones due to the necessity of having personnel competent to do all the office work with the exception of possibly the bookkeeping. That is, each office employee must be thoroughly familiar with all office procedures and policies of the department. The larger offices have sufficient work to make it practical to assign employees to particular duties. It falls to the manager to set up the records, forms and procedures that will provide the best service to the consumer, give him the information he requires and avoid confusion in carrying out the work. Necessarily, he is in much closer contact with his employees than is true of the manager of a large utility and has the opportunity to observe how each carries out his or her duties. This is a great advantage because duties of the office employees can be changed so that each can do the work best suited to that individual. It may be found that one or two may be especially qualified to deal with the public, particularly in the matter of complaints. It is then to his advantage to see that the majority of com-

plaints are handled by those best equipped to do this type of work.

Without sufficient finances it is not possible to operate a water system efficiently and economically. It is the duty of the manager of a small water-works to see that monies due are collected and also that accounts payable are paid when due.

Rate Studies and Adequacy of Supply

If the rates do not provide sufficient returns to properly operate and maintain the system and provide a reasonable surplus something must be done. After a careful survey has been made to determine that no further operating economies are possible, that leaves only one alternative —namely, an increase in the rates so that proper service and maintenance can be provided. Depending on the type of system, whether municipal or private, this can be done by the city council or approved by the State Public Utilities Commission. Detailed financial data are necessary to convince either that water rates should be increased, and it is always well to advise consumers in advance of an increase in rates and the necessity for it. The newspapers can be very useful in this endeavor. If the editors can be convinced that a rate increase will provide better service or a better quality of water they will advocate the increase and help sell the idea to the public. There are different ways of figuring and developing rate structures and, unless one is familiar with this important phase of public utility operation, it is wisdom to get competent advice on the subject and help of experienced engineers and/or financial advisors.

Looking and Planning Ahead

Some cities have been hard pushed to keep ahead in their supply of water, particularly those which are not 100% metered. The manager is usually thoroughly familiar with the situation, but often finds it most difficult to sell either the consumers or the governing body on the proposition. However, in many instances he is going to have to sell someone on the idea or his funds will eventually become insufficient to keep the supply ahead of the demand. This leads to water use restrictions and condemnation of the public.

One Solution of the Complaint Problem

(But it doesn't fit into anybody's book on "Improving Public Relations.")

When a manager operates on a strict budget he must look ahead and anticipate what improvements have to be made within a certain period of time, and whether his budget will be large enough to finance such improvements. If, as at present in many cities, there is a large influx of new people, and a demand for suburban homes, with consequent development of new subdivisions and home building not anticipated a few years ago, this calls for extensions to care for the newly developed areas. In turn, there must be some method of financing these mains. This is the manager's job also. Can he do this with his present income or will it be necessary to issue bonds to not only make the extensions but provide additional quantity of water to serve the newly developed areas. What income will be derived from the new areas. Will it be sufficient to amortize the bonded indebtedness or will it be necessary that those developing the areas put up some part, or all, of the cost of the water mains with some method of whole or partial repayment to the developer as homes are built.

Treatment of Complaints

The duties of the manager of a small water system are many and varied. He usually becomes pretty well known to his customers. Therefore, if there is a complaint to make, it is made to him. He must be impartial, treating alike his friends and those he is not acquainted with. He is going to make some enemies, but on the other hand he will make a great many more friends in the long run.

The consumer wants water when he opens the tap and he wants a clear, palatable, odor-free water. If he gets this he makes little complaint, but if he gets turbid water or one with a taste or odor he will make himself heard. The manager can keep his system blown off at proper intervals to prevent some of the above defects in water quality, and particularly troublesome spots can be blown off more frequently. If the trouble is due to the raw water then his duty is to see that proper methods of treatment are either inaugurated with present equipment or new equipment be installed to properly treat the water.

Regular audits by an outside auditor are an important part of the records. A general audit made once a year, supplemented by quarterly audits of a comparative nature, are most helpful. These "check ups" provide the manager with information as to his costs of operation and maintenance as well as giving him a comparative statement of the cost of the same items for the previous year.

Aside from the duties outlined in this article the manager has many other possible duties, depending on his personality. For instance, he may enter actively into civic affairs, either by choice or as a matter of expediency. Either way, properly done, this participation in public affairs will be a help to the water utility—and its entire personnel, from meter reader to manager.

SIXTH PURDUE INDUSTRIAL WASTE CONFERENCE PLANNED

Scheduled for Feb. 21, 22, and 23, 1951

Plans are now being formulated for the sixth Purdue University Industrial Waste Conference, to be held at Lafayette, Ind. on Feb. 21-23, 1951. As in the past this conference will be under the Chairmanship of Don E. Bloodgood, Professor of Sanitary Engineering.

Professor Bloodgood is looking for good papers and speakers to include on the program. Papers are desired covering the most recent phases of industrial waste treatment, utilization, or elimination. Speakers are encouraged to make sure that the information presented will be a specific aid in solving waste disposal problems.

If you have any suggestions as to papers or speakers which should appear on this program, write to Prof. Bloodgood, who urges that authors not be modest in suggesting that they report their own most recent work.

For those of you who have never attended one of these Purdue Industrial Waste Conferences, you should plan to attend. So successful has this conference become that it is hard to obtain reservations for it. The high esteem with which this conference is held is attested by the fact that last June, Mass. Inst. of Tech. started an industrial waste conference patterned on the lines of the Purdue Conference.

ARE WE READY FOR HIGH-RATE FILTRATION OF WATER?*

by
JOHN R. BAYLIS†
Engr. of Water Purification
CHICAGO, ILL.

SOME engineers are not, as yet, convinced that water of excellent quality can be produced at high rates of filtration in practically every filtration plant in the country that is provided with adequate means of properly conditioning the water for filtration. We may, therefore, list the fear of lessened bacteriological efficiency as the No. 1 objection to high-rate filtration.

The Author

Views on High-Rate Filtration

With an ear turned to any conversation about high-rate filtration, the writer has heard remarks that lead him to believe that one should expect replies about as follows from public health and water purification engineers to the question. "What do you think of high-rate filtration?"

Mr. A. says he has not thought much about the subject, but is against it because it will cause depreciated bacteriological quality of the water.

Mr. B. is of the opinion that satisfactory water can be produced at filtration rates considerably in excess of the conventional 2 gal. sq.ft. min. rate. He can see no objection to designing filters for a rate of 3-gal. per min., since many plants are now using rates this high and higher, and are producing satisfactory water.

Mr. C., a State Sanitary Engr., says he is holding an open mind toward high-rate filtration, but will not approve its use in his state. Asked if he thought filtration plants could produce safe water at high filtration rates, he replied that he did not know, perhaps the better operated plants could.

Mr. D. says, why use high rates of filtration when it would not cost much more to construct the plant large enough for the 2 gal. rate? Asked if he believed safe water could be produced at high rates, he stated it was doubtful if it could. He was then asked if he thought chlorine would be less effective in water passing through a filter bed at 4 gal. per minute rate than at a 2 gal. rate, and replied he did not see why it should be.

Mr. E., a practical filtration plant operator, says that plants all over the country are producing good water during their peak demand periods at filtration rates of 3 to 4 gal. sq.ft. min.

Thus we see that opinions vary, caused mainly by a fear of some that the filters will break through and discharge a large amount of coagulated material into the distribution system. The question of using rates of filtration in excess of the 2 gal. per min. rate, therefore, should resolve itself into one of considering whether or not our filtration plant operators are capable of properly conditioning the raw water for filtration. A large percentage of them are. Those who are not capable, likely are not producing water of the highest quality in the plants they are now operating at the conventional 2 gal. rate.

Experience with High-Rate Filtration

In an article presented at the Philadelphia conference of the American Water Works Association last May, the results of our experience at Chicago in operating filters at rates of 2 to 5 gal. per min. per sq. ft. were given. This was published in the July, 1950 issue of the Journal of this association. The tests showed that, with filter sand at 0.65 to 0.70 mm. dia. effective size, the coagulated and settled Lake Michigan water could be converted to water of the highest quality at filtration rates as high as 5 gal. per min. per sq. ft. of filter surface. The experimental results, as given in this article, show that:

1. The time in service for filters operated at 5 gal. per min. per sq.ft. averaged 96 per cent of the total time. Under the worst conditions, the time in service would be about 92 per cent. This would compare with an average of about 98 per cent for filters operated at the 2 gal. rate, and 95 per cent under the worst conditions.
2. The initial loss of head through the sand bed at 74° F. is 0.4 ft. at the 2 gal. rate and 0.9 ft. at the 5 gal. rate. At 32° F., the loss is 0.7 and 1.8 ft. respectively.
3. The lengths of filter runs for a period of one year averaged close to twice as long for the 2 gal. rate as for the 4 gal. rate.
4. The turbidity of the effluent from filters operated at the 5 gal. rate averaged only 0.076. Nearly all of this was colloidal and not floc turbidity. Turbidity measurements were not made on individual filters operated at the 2 gal. rate, but it could not have been much less.
5. The floc turbidity of individual filters was measured on the filters operated at the 5 gal. rate. Only 0.1 per cent of the samples showed flocculated turbidity in measurable quantities.
6. The general average of coliform bacteria was no higher on the high-rate filters than those operated at slower rates.
7. The filter performance (gallons of water filtered per foot increase in loss of head) was greater for the high-rate filters, indicating there may be a slight saving in wash water.

If this can be done in Chicago, it can be done in most any filtration plant in the country.

Opposition to High-Rate Filtration

So far, most of the opposition to high-rate filtration has come from state public health officials and a few of the consulting engineers. The health officials, of course, should be the first to speak out against any change they fear may lessen the quality of the filtered water. Those who have followed the writer's work know he would be the last person in the United States to advocate doing anything that would lessen the quality of our drinking water. May he remind you that almost no attention has been given to his cry of more than a decade for more rigid becteriological, turbidity and palatability standards for drinking water.

By way of taking a few strikes at some of these health officials, and with no thought of offending, attention is called to a few actions not understandable. Some of the State officials who have given little support in promoting more rigid water standards and who do not seem greatly concerned about some of the unfiltered surface water supplies in their own state, act as though they are ready to "jump ten feet in the air" when one mentions increasing filtration rates to conform more with what a filter is capable of doing without decreased efficiency.

On the other hand, many of our public health officials are going to look at high-rate filtration in a sane manner. Their good record of tolerance in allowing, and in encouraging, use of new ideas in water purification shows wisdom and judgment in the

* Excerpts from a paper read before the Penna. Water Works Operator's Association, here printed by permission of the Association.
† Editorial Associate, *Water & Sewage Works*.

exercise of their power over design and operation of filtration plants. They have no desire to make the cost one dollar more than is necessary. After all, their function is not one of design and operation, but safety from the transmission of diseases by water. It should make no difference to them if water is passed through the filter beds at 0.5 gal. per min., or 5.0 gal. per min., so long as the filtered water is free of disease-producing bacteria at either rate. After practice demonstrates beyond a doubt that no increased risk is incurred, opposition should fade away.

Progress in Water Purification

Within my lifetime, cities have gone from no filtration, no chlorination, and a high death rate of water-borne diseases, to a death rate nearing the vanishing point. This was accomplished before there was free residual chlorination for polluted supplies to kill all disease germs. Much stress, years ago, was placed on the biological film around the sand grains, because it was thought this film was an essential to good bacterial removal in the filter beds. The attitude of "treat the sand in filter beds very gently in backwashing lest the biological film around the grains be knocked off," has given way to "give the sand grains rough treatment with surface washing system," or by any other means, to keep the grains clean so that better removal of the coagulated material will be accomplished.

Before using filter bed surface washes, it was nothing uncommon to find filter beds that pulled away from the sidewalls of the filters one-half to one inch or more at the top of the beds with cracks extending downward nearly to the gravel. These cracks opened up after there was some increase in the loss of head on the bed. Part of the settled water, therefore, bypassed most of the filtering material and entered the sand bed sideways where the sand was coarse, the distance to the gravel short, and at localized rates of filtration much in excess of the 2 gal. rate. This is not to infer that public health officials approved such conditions, but they have not given as much help in bringing about improvements as I thought they should. So long as the water was properly chlorinated and within the bacteriological requirement, they approved its safety.

Reliance on Chlorination

When filtration designers and operators were worrying about filter beds producing high bacterial reduction, and generally were expecting an overall plant reduction without chlorination of 98 per cent, public health officials were turning their attention to chlorination, which was beginning to be widely used about 1913. State public health sanitary engineers have done an exceedingly good job in the promotion of chlorination of the water of our public supplies. In 1913, no filtration designer was willing to admit that he could not design a filtration plant that would not produce safe water without chlorine, and almost no operator of a filtration plant would admit he needed to use chlorine.

Chlorination practice, at first, was largely to add the chlorine after filtration to save that "all-important biological film" around the sand grains. By adding chlorine after filtration, the efficiency of the filters still could be determined. Each filtration plant operator's opinion of safe drinking water was the water he was producing in his own plant.

In 1914, the first standard of water quality was adopted by the U.S. Public Health Service for water used on common carriers. This set the standard of water quality throughout the United States. A large percentage of the filtration plants found it impossible to meet these requirements all of the time without chlorination. Echoes of the protests of the operators of some of our filtration plants are still ringing in my ears. Notwithstanding this, chlorination was extended and was relied on to kill the bacteria in the treatment process. The effort to adopt a more rigid bacteriological standard in 1924 and 1925 again brought forth protests from some of the filtration plant operators, but progress continued and the more rigid standard was adopted by the U.S. Public Health Service in 1925.

Chlorination has continued to make progress. By 1925 a few were so bold as to chlorinate the water *before* filtration, and found improvement instead of disastrous results. By 1935, ammonia to lessen chlorinous taste was being widely used. Then came high chlorination called "breakpoint" chlorination, and now more scientifically referred to as "free residual chlorination." Free residual chlorine is regarded as the most powerful oxidizing and germicidal agent for practical use in treating water. The prechlorination of all contaminated water to a degree beyond the "breakpoint," determined by the presence of a considerable excess of *free residual chlorine* is now the practice. Is there a single one of you who believes this will not insure a water safe bacterially? Chicago's typhoid death rate dropped from an average of about 50 per 100,000 inhabitants in the last decade of the nineteenth century with no chlorine, to 0.03 in 1945 with complete chlorination since 1917. Prechlorination has knocked the coliform bacteriological efficiency of filters from 98 per cent to zero. There are no live coliform bacteria in the water going to the filters, and none are present in the filtered water. The water, however, is much safer than that produced by the old practice of post-chlorination only, and filtration becomes a means of straining out coagulated matter and polishing the already safe water.

It seems absurd to talk about high filtration rates increasing the danger of water-borne diseases. Now that water purification plant operators have become chlorine-minded, they have in most instances gone considerably beyond the demands of health authorities in chlorination. These operators have taken the lead in water safety, and they expect to maintain this lead. It would seem unfair should public health officials deny water works the right to take advantage of this excess safety to lessen the construction cost of filtration plants by employing high-rate filtration.

The objective in considering at length the safety produced by chlorination is to stress the fact that water safe from water-borne diseases can be produced at *any* rate of filtration. Assume that a filtration plant is producing water in which the coliform bacterial content is only one-twentieth that allowed by the U.S. Public Health Service, and many of the plants are producing water as good as this or better. Do certain officials fear this figure will be increased by high-rate filtration to where the coliform bacterial content is say one-fifth, instead of one-twentieth, that of the requirement? The evidence from plant performance indicates there will be no such increase.

Let public health officials set the figure for coliform bacteria desired of water works, and I assure you this figure will be met at any rate of filtration the plant may choose to use. We can rub from the slate, objection No. 1, relating to bacterial safety, and this is the major objection.

Clarity of Filtered Water

Objection number two, is that more suspended material will pass through the filter beds at high filtration rates than at low rates. For the sake of argument, let us assume this is true; however, it is not to the extent believed by many. One thing should be made plain: any filtration plant that cannot filter water at high rates with an increase in turbidity that is still well below objectionable limits, should not use high rates. Such plants

would be few, and proper conditioning of the raw water could correct nearly all of these few. Remember, there is a treatment for toughening coagulation that will produce clearer filtered water at a 4 gal. rate than can be produced at a 2 gal. rate without use of the toughening agent. The argument then may be that the plants will not use the treatment.

Should a toughening treatment not be used, increasing the filtration rate from 2 gal. to 4 gal. per minute would not greatly increase the turbidity of the filtered water. The need for high-rate filtration generally occurs in the summer months when the flocs produced in coagulation are the toughest. Chicago has found no need of a toughening agent in summer months at a filtration rate of 5 gal. per min., whereas there is a need for strengthening at times in the winter months at the 2 gal. per min. rate.

The writer has advocated water quality in which the turbidity of the filtered water averages not more than 0.2, realizing there are a few places in which this may have to be slightly higher. Plants, supposedly operated in an efficient manner, have been observed in which the filtered water averaged at least 1.0 and often contained turbidity as high as 2.0. In most such plants water of 0.2 turbidity or less could be produced easily, and at only a slightly greater cost. Some years ago, on a visit to a fairly large filtration plant, it was observed that the filtered water was not clear. The water had a turbidity that must have been between 2 and 5. A remark to the operator that the water was not clear brought forth the reply that he thought it was good practice to keep the consumers accustomed to a little turbidity. This was in a state with a good health department, and a city with a low typhoid death rate. This city probably did not have a single extra typhoid fever case as a result of the treatment, but the water did not meet the desires of many of the consumers.

Filter Rating

Perhaps some of the difference in viewpoint would be cleared if there were a better definition of the rating of filtration plants. Very few plants are operated at a constant rate, hour after hour, day after day, month after month, and year after year. New plants generally are constructed in excess of immediate needs. The designing engineer determines present average and maximum rates of consumption and assumes a rate of increase for a period of years and the plant is constructed with excess capacity. For a few years the person operating the plant thinks little of the capacity, for it is ample for all needs. On some hot dry day the rate of filtration climbs to the rated capacity of the filters at 2 gal. min. sq. ft. of filter area. He thinks little of it, for he knows the filters are capable of filtering at a higher rate and that it will drop off within a few hours.

The next year the maximum rate may go above the rated capacity of the filters for several hours on several warm hot days. Each succeeding year the maximum rate goes higher, and the time in which the filtration rate is above rated capacity increases. One year it is 10 per cent of the time, a few years later it is 20 per cent of the time, and soon it is 30 per cent of the time. Somewhere along the line, the operator begins to advocate increasing the plant capacity. The filter rate controllers may be constructed to give a rate of 50 per cent in excess of the 2 gal. rate. When the demand exceeds the maximum capacity of the filter rate-controllers a few times the operator begins to tear out his hair trying to get an addition to the plant. The extension eventually is made and there is no further anxiety over the rated capacity for a number of years.

When has this plant exceeded its rated capacity? Each designing engineer and each operator likely would give a different answer. Should it be when the rate is over the 2 gal. rate 5 per cent of the time or should it be when it is greater than this rate 50 per cent of the time? In many plants where the minimum hourly rate is only one-half the maximum hourly rate, and the winter load is but 75 per cent of the summer load, or even less, the filter rate controllers may not have capacity great enough to allow the plant to operate in excess of the 2 gal. rate 50 per cent of the time.

The writer suggests that a filter be construed as having reached its rated capacity when it is operated more than 10 per cent of the time above its rating. This kind of rule is by no means a perfect one, for in many plants the rates of the filters are set at the maximum expected, and filters are cut out of service to take care of plant rates that are less than the maximum. A plant provided with rate controllers for 50 per cent overload may be construed as having reached its ultimate capacity when the maximum hourly rate for the year has reached the rate of the rate controllers. Should the ultimate capacity be reached before there is operation more than 10 per cent of the time above rated capacity, then the plant should be increased.

Assume a filtration plant has 6 filter units, each of which has 695 sq. ft. of filter surface. At a 2-gal. rate, each filter would filter 2.0 million gallons in 24 hours, or a plant total of 12 million gallons with no allowance of time for washing. At a 3-gal. rate, each unit would filter 3.0 million gallons daily, or a plant total of 18 million gallons. When the water filtered during a year is 7 million gal. daily average, most likely there will be a peak hourly rate of 12 mgd. As the consumption of water increases to a yearly average of 9 mgd, the maximum hourly rate likely will go to 15 million gal. The percentage of time in which the rate is above the 2-gal. rate may be close to 10 per cent. If the filter rate controllers provide for a maximum rate of 3.0 million gal. each, then it is time to increase the filter capacity if the 2-gal. rate is to be maintained. Should the rate controllers provide for a maximum rate of 5 million gal. each, then there is no need for increasing the filter area, although the mixing and settling basins may need to be increased. Good conditioning of the water is an essential, and the hydraulics of the flow through the filter units must be such that there is not excessive loss of head.

When the average yearly consumption increases to 12 million gallons, the maximum hourly rate likely will be about 20 million gallons. The percentage of time in which the rate will be above a 3 gal. rate probably will be about 5. With 3 gal. per min. set as the rated capacity, some additional increase in rate could be obtained before more filters are required. The peak hourly rate would be 24 million gallons. With good hydraulic conditions in the filters there should be no difficulty in operating at this rate a few hours daily.

No Saving in Mixing and Settling Basins

Assurance that rates of filtration higher than the 2 gal. per min. rate may be used, does not mean that present plants can increase filter rates, per se. A plant designed for mixing and settling at a 2 gal. rate would halve the time at a 4 gal. rate. Thus water not properly conditioned might reach the filters. Many plants that are now in need of greater capacity, could increase only the mixing and settling time and this would be sufficient for some time in the future, if the hydraulics through the filters will allow the increased rate. All new filters should be designed with piping and conduits to allow filtration rate of at least 4 gal. per min. per sq. ft. without excessively high friction loss.

THE SUPERVISOR'S STAKE IN SAFETY*

by

HAROLD F. WEBB
General Safety Director
AMERICAN WATER WORKS, INC.
NEW YORK, N.Y.

DURING my entire 35 years of association with industrial life, I have always had a profound respect for men who were rated as supervisors or foremen. Supervisors have frequently been called the "key men" of industry; and for my money, they are all of that and more! But, above all, they must be leaders of men.

The characteristics which are ideal for leaders are: Loyalty, character (a quality that takes a lifetime to make and a second to lose), tolerance, humor, modesty, initiative, poise, happiness, health, personality, self-respect, job pride, and a sense of obligation for the safety of the men under them.

I should like to examine more closely and discuss that important obligation—the safety of the men working under supervisory influences. Since the production of the whole working force is the sum total of the product of each individual in the force, the attitude of the individual himself is of paramount importance. Therefore, when safety is recognized to be an important factor in a plant's operation, efficiency prevails and production results are favorably affected. This direct connection between safety and production throws a heavy load on the shoulders of the supervisor. His part in the relation of safety and production is vital; his responsibilities and opportunities, great.

There are those who still look upon safety as a fancy trimming, unaware that sound management has long since discovered that safety is an investment which pays handsome dividends in reduced compensation and medical expenses, in more and better production, and in heightened employe morale.

Production and Safety

In a nation-wide poll, this question was asked: "What are the things for which you as a supervisor are responsible?" In almost every case, the No. 1 answer was, "Responsible for getting out production." Because the supervisor is responsible for the amount of production of the employes under his supervision, anything which interferes with expected production must be his immediate concern.

Production does not always mean the actual making of some article. It may mean the handling of materials or the delivery of the finished product to the consumer. It may mean the maintenance of buildings or equipment; the operation of boilers, and engines; or the supplying of safe and potable water, or the disposal of sewage. Whatever the job may be, production is an essential part of the business and any interference with its functioning is considered as an interference with production. To prevent any such interference is a part of the supervisor's responsibility.

The loss of employes' time because of illness is one source of interference with production. Many illnesses, however, may be the result of unsafe practices or conditions, as, for example, wearing improper or insufficient clothing or footwear, or working in areas not properly protected from drafts. But the greatest interference is almost always the result of accidents. They may result in injury to persons or serious damage to machines or equipment. Sometimes both are involved. It is the supervisor's responsibility to stop this source of interference with his production.

When a supervisor says, "I know what my men should do to avoid accidents, but how do I get them to do it? I've told them what to do, what more do you expect of me?" he very likely does not associate accident prevention with the prevention of production errors. That same supervisor, however, may have the answer for production troubles. There never seems to be any doubt in his mind as to how to act in such an event, because he recognizes the fact that production might suffer —and it is his first responsibility to get out production. But it is also his responsibility to get it out without accidents or injuries. It is true, of course, that an accident and an injury do not occur every time something is done in an improper manner. But it is also true that if improper methods are permitted to continue, accidents will occur, and both injuries and production losses might result.

Efficiency and Safety

Accident prevention and efficiency in production go hand in hand. The causes of production troubles are the same as the causes of accidents. Time is lost because material is not piled properly. Time is lost because aisles are blocked with boxes or material that should not be there. Time is lost because the wrong kind of a wrench or other tool is used. And only sometimes do these same improper actions cause injuries. But every time they do occur, operating efficiency suffers.

You are concerned about preventing accidents that take a machine out of production whether or not someone is hurt. Accident prevention implies the elimination of not only accidents that result in personal injury, but accidents that result in loss of time, damage to your equipment or products, and interference with your planned procedure.

There is a right way to do every job. If jobs are properly planned and are done as they are supposed to be done, we will not have accidents. That, in short, is all there is to accident prevention—to get people to do their jobs in the way they should be done.

I have already indicated that supervision must bear the brunt of work necessary to reduce the accident toll. Plant management, sincere in a desire to cooperate, may organize and initiate the most perfect reduction plan which can be devised. The workers, stimulated by appeals, may wish in all earnestness to avoid injury to themselves or others. But unless supervision successfully converts the management plan into a program of action and shows the workers how to translate their desire for safety into consistently safe work practices, the reduction can never be attained.

Why are supervisors so essential in a safety program? Because the real secret of successful safety lies in the control of three factors—physical conditions, work practices, and human behavior—over which supervision has primary direction. Unless the supervisor reports the need for the purchase and installation of safety equipment, the repair and maintenance work necessary to assure safe working conditions, management will never know of the problem. And unless he keeps calling attention to the condition, management, busy with a hundred different problems, may never act on it.

*Presented before the Penna. Water Works Operators Assn., and condensed for publication here by permission.

The same is true of safe work practices and human behavior. The supervisor has the primary duty of training new workers on the job, and of overseeing the work of these and older employes to be sure that it is done correctly and safely.

Examples of Supervisory Failure

Many examples show failure of supervision as an important factor. A study of 18,000 accidents indicated failure of supervision as related to the causes of accidents in 73 per cent of the cases. These failures arise from a lack of corrective action when obviously dangerous hazards exist, or from a lack of knowledge of the hazards on the part of the supervisor or the employe.

We are all interested in the development of a better knowledge of the relationship of safety to efficiency and production. There should never be a compromise between safety and production. Occasionally, however, there arises a situation where a misguided effort to get more production involves action by the supervisor that increases the operating hazard.

A typical case is that of the supervisor who was responsible for the pipe fitting in a large chemical plant. In this plant there were two sources of water, one the normal city supply, and the other a supply from a pond located on the plant's property. The water from the pond was intended to be used only for cooling purposes in the plant. Through a lack of knowledge or lack of thought on the part of the supervisor responsible for the piping system, cross connections were made between the city water piping and the pond water piping. The water from the pond was polluted and certainly not potable. Fortunately, the distinctly bad conditions caused by the improper piping were discovered before much damage had been done. If the conditions had not been discovered, a tremendous loss could have occurred to the plant. Here was a clear-cut failure of supervisory responsibility.

As a supervisor, you should observe the day-to-day occurrences of mechanical unsafe and improper conditions. You should take the necessary action to eliminate or control such hazards in order that your department and your plant may profit by such action. You will also have the personal satisfaction of knowing that you have contributed not only to the prevention of serious injury to a fellow man, but that you have also raised the level of your own efficiency as a supervisor.

The Human Element

It will be remembered that I mentioned "Human Behavior" as one of three important factors which govern the end result to be obtained from productive effort.

Any factor which interferes with "getting out work" is a factor that must be dealt with effectively by the person supervising that work. If the human factor is slowing down the work, then the human factor becomes just as much a part of the supervisor's job as the adjustment of a piece of mechanical equipment which is holding up production.

Human behavior as a factor of resistance to productive efficiency bears directly on the very core of the safety problem. When we are able to so analyze a person and, by suggestive or positive appeal, control his work actions to a point where a safe habit is formed, a great deal will have been accomplished. A skillful supervisor will usually be able to find quickly the condition or fault motivating the misbehavior which may be assumed as the potential accident- producing factor, and apply suggestive or positive treatment to provide the cure.

We have learned that a large percentage of industrial accidents are caused by the human element—the seemingly unpredictable actions that may be traced variously to training, environment, native ability, etc. How often do we ask ourselves how many of these faulty actions on the part of workmen under our charge might be the result of thoughtlessness on our part in dealing with these men? Do we remember that they are human beings—subject to the same emotional and psychological disturbances that would affect any of us under the same circumstances? If it is our job to handle men and if we hope to influence them in attaining safe and efficient production, we must keep in mind primary psychological factors (Internal Factors — character, ideals, wants, interests, passions, illusions; and External Factors—suggestion, prestige, mental contagion, fashion, and custom) responsible for human behavior.

Water Works Accidents

Right here let me briefly cite some of the more predominant causes of work injuries among the 2500 employes who compose the personnel of 65 plants of the American Water Works Co., Inc. Undoubtedly, the pattern is the same at any water plant. Unlike industries engaged in the manufacture of steel and steel products, chemicals, synthetics, etc., where there are specific hazards to control, our industry runs more to hazards common to all. Therefore, while we have a real accident prevention problem, we need little special equipment except personal protective devices to reduce or eliminate these painful and costly accidents.

According to studies made of last year's accident record, 66 per cent of all employe injuries arose from four main sources: (1) Handling Materials, (2) Hand Tools, (3) Flying Objects, and (4) Falls. There should be little question that personal injury accidents in these categories can be greatly reduced by more alert attention to the work habits of the personnel by supervision.

It is obvious that the mishandling of materials is the direct cause of many back strains, hernias, foot and hand injuries.

Handling Materials

Now, a few words about the manual handling of materials . . . such materials as lime and alum in sacks should be handled by two men, each man taking hold of one end of the sack and swinging it onto the pile, truck, or skid. If sacks of material are light enough to be handled by one worker, he should grasp the sack firmly on opposite ends and corners, raise to the carrying or piling position, keeping the sack close to the body. Physical differences in individuals make it impractical to set up positive safe lifting limits for all workers. The U. S. Department of Labor has set 50 pounds in compact form as the safe weight lifting limit for men. However, regardless of the weight, shape or size of the object to be lifted, all workers should be instructed in proper lifting technique.

Hand Tools

Hand tool accidents accounted for one in every five employe injuries, year 1948. Behind all hand tool accidents there are one or more of four primary causes: (1) A wrong or improvised tool, (2) A defective tool, (3) Tools incorrectly used, and (4) Tools not put away. There is a need for training workmen in the correct use of tools, and this training can best be done by the supervisor during his daily contact with them.

Generally speaking, in all operations where one metal hand tool strikes another, where equipment or material is being struck by a metal hand tool, or where the cutting action of a tool causes particles to fly, eye protection is needed by the user of the tool and by other workmen who may be exposed to flying particles. Goggles or face shields should be worn around all hand tool operations, including chipping concrete, drilling, shoveling material head-high, using wrenches and hammers overhead where particles

of materials or debris may fall, and wherever there is danger to the eyes.

Falls

What is there to say about "falls" except that this is one of the most prolific sources of injury and death and is surpassed only by the automobile. Men continually fall up or down stairways; in or out of trenches; from ladders, scaffolds and other elevated surfaces; and by slipping and tripping on smooth or rough floors and over improperly stored material and debris.

In passing I shall simply mention the other general injury causes as electrical; machinery; hoisting equipment; motor vehicles; railroad cars; fire and heated substances; chemicals and gases; explosions; slides and cave-ins; falling, moving and striking objects; poisonous vegetation; animals; and weather conditions. After careful analyses, 70 per cent of the reported injuries were properly chargeable to HUMAN FAILURE, and a large portion of these accidents could be traced to supervisory failures.

Supervisor's Responsibility

The accident rate, like the production rate, is the responsibility of the supervisors. They are given the authority to take whatever steps may be necessary to attain efficient, economical production, which means, among other things, production free from the worker injury, plant damage, and material spoilage which result from job accidents.

Any safety program can be successful when supervision is able to see that the conditions and circumstances which cause accidental injuries are the same conditions and circumstances which delay production, increase costs, and bring about lower quality or production and lower employe morale.

To a great extent, the success of the plant production program depends upon the attitude of the supervisor. He is closer to the workman than is management. He is closer to the management than is the workman. He is responsible for the production activities of the men under him and should be responsible for their safety. If he believes in safety, practices safety, and insists upon safety, then safe production will be the result.

Janzig Becomes Supt. Water Treatment at Minneapolis

A. C. Janzig has been made superintendent of water treatment at Minneapolis, Minn., succeeding A. F. Mellen, retired.

Mr. Janzig, a former chairman of the Minnesota Section of A.W.W.A., has served the Water Dept. of Minneapolis for 29 years as chemist and assistant superintendent of treatment. He will have charge of the Fridley Softening and Filtration Plant and the Columbia Heights Filtration Plant, both treating Mississippi River water.

An Angle in Public Relations

Some one in the Public Works Dept. of Gaffney, S.C. had a bright idea 19 years ago in the direction of bettering Public Relations in this alive South Carolina town.

For the past 18 years (this year being the 19th) the Public Works Dept. of Gaffney has bought sizeable newspaper space to tell the community at large, and much of South Carolina, that the customers of the Gaffney Water and Light Utility are to be the recipients of a Christmas Gift in the form of free water and electric current for the month of December.

The accompanying cut was made from a ⅔-page ad. which ran in the *Gaffney Ledger* of Dec. 22, 1949. The copy reads—

GREETINGS FOR CHRISTMAS
For the
18TH CONSECUTIVE YEAR
It is Our Privilege to Announce
That All
WATER & LIGHT BILLS
For the Month of December Will Be
MARKED PAID

Your Board is again delighted to be able to make this announcement and pass on to you this saving at a time when it will mean most to a great many of you.

MAY YOU AND YOURS HAVE A MOST ENJOYABLE HOLIDAY SEASON

BOARD OF PUBLIC WORKS
Gaffney, S.C.

For the past several years copies of these ads have been sent us by L. V. Gaffney, Supt. of Public Works at Gaffney. This one struck us as being especially attractive and attention-getting, besides being a stimulant to Christmas trade. (Gaffney Chamber of Commerce please note.)

Greetings for Christmas
FOR THE
18th Consecutive Year
It Is Our Privilege To Announce That
Water And Light Bills
For Above Readings For The Month Of
DECEMBER
— Will Be —
Marked Paid
MAY YOU AND YOURS HAVE A MOST ENJOY-
ABLE HOLIDAY SEASON
BOARD of PUBLIC WORKS
of GAFFNEY, S. C.

Municipal and Rural Sanitation

The McGraw-Hill Book Co., New York, N.Y., has published a book titled "MUNICIPAL AND RURAL SANITATION," by Victor M. Ehlers and Ernest W. Steel. This book, the new fourth edition, deals with those fundamentals of general sanitation which should be familiar to the sanitary engineer, the sanitarian, and the public health engineer. Basic information is given concerning the diseases which preventive sanitation eliminates, and a brief description of the field of public health is included. Sewage disposal and water supply are discussed from the point of view of operating problems, which leads to a discussion of subsequent solutions.

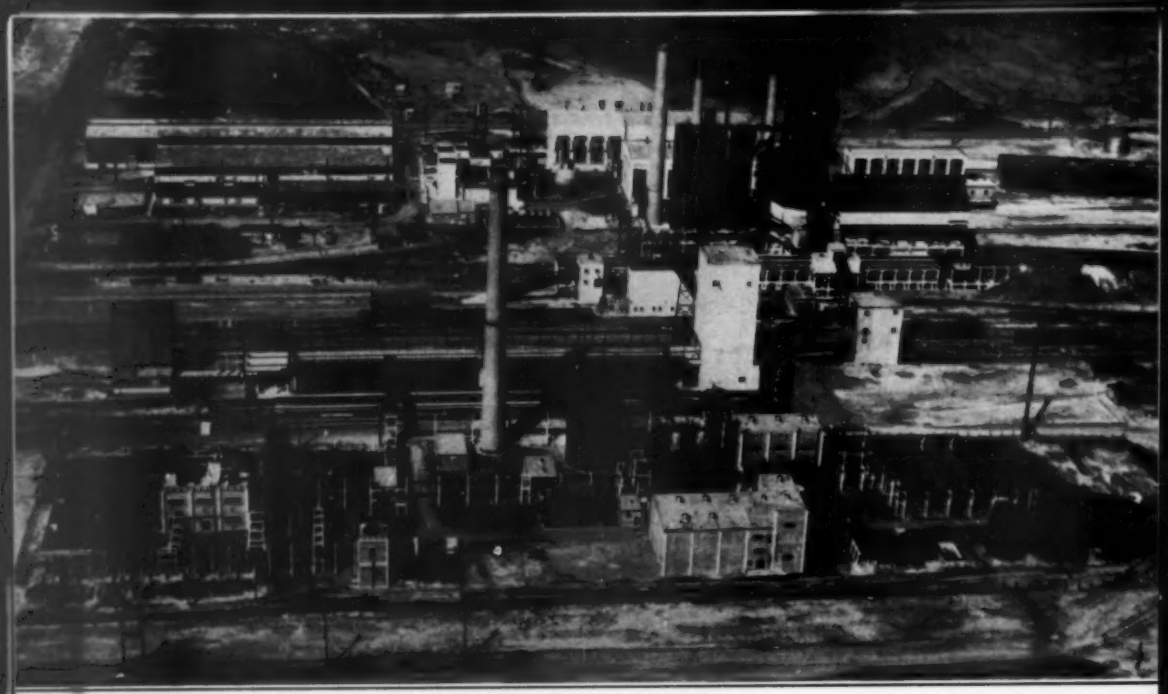
Consisting of 548 pages, amply illustrated with diagrams and photographs, the book may be obtained from the McGraw-Hill Book Co., New York, N.Y. for $6.50 per copy.

A Vicious Cycle

While federal grants-in-aid already make up about 40% of all money spent by *local governments* and 15% of the money spent by *states*, the ratios are steadily increasing, according to findings of the Hoover Commission.

And as grants-in-aid increase, the federal government must broaden its tax base to get the money. This makes it more difficult for state and local governments to get their own revenues; hence pressure is stimulated for still more federal grants-in-aid.

The over-all effect, then, is that federal agencies are being greatly expanded and national taxes increased.



Lone Star's Main Plant at Lone Star, Texas

New 80,000 ton Cast-Iron Pipe Foundry in upper left; Byproducts Plant in foreground; battery of 78 Coke Ovens in center; Blast Furnace and Power Plant in upper right. Ore pits are within sight of plant; company owned coal mines are in Oklahoma.

A NEW CAST-IRON PIPE PLANT IS BORN

Will Serve the Southwest and Midwest in Particular

by
L. D. WEBSTER
Lone Star Steel Co.
DALLAS, TEXAS

LEAFING another page in a remarkable expansion program which has seen its assets exceed $50,000,000 in little more than two years, Lone Star Steel Company, of Texas, in October completed a new cast-iron pressure pipe foundry valued at $1,500,000. Thus, Lone Star, on an ore-to-end-use-product basis, stands in a unique position amongst cast-iron pipe producers.

Ore is mined within sight of the company's 27-foot blast furnace which is known by the pet name the "Flossie Bell." (See cover picture.) Pig iron from the "Flossie B." travels less than a city block to reach the new pipe foundry. Company owned coal mines are located at McAlester, Oklahoma.

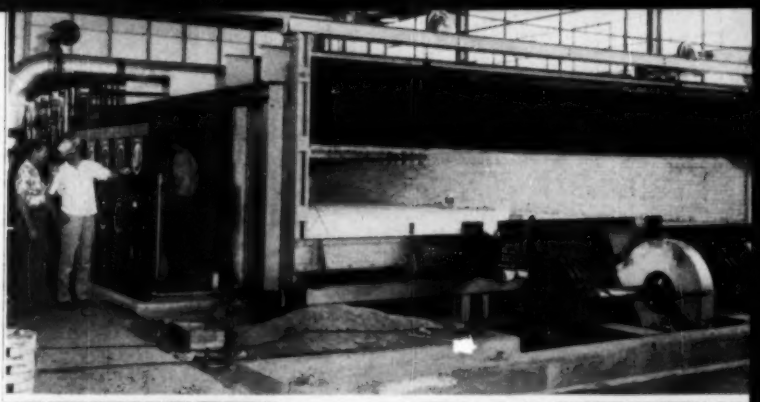
Lone Star officials are scheduling a capacity operation by the end of October. Trial runs are proceeding nicely and with materials already at hand, little trouble is expected in meeting an 80,000 ton annual schedule of cast-iron pipe output.

The new foundry is located at Lone Star, Texas, less than 150 miles northeast of Dallas. Diameters of pipe now being turned out range from three to 12 inches. Section are being cast up to 18 feet. On order is another machine which will increase diameters to 20 inches. All sizes of pipe are being centrifugally cast.

The foundry was constructed under the supervision of W. R. Bond, general manager of operations, and Don Hooser, plant engineer. W. C. Fearn is the pipe foundry superintendent. According to E. B. Germany, Lone Star president, pipe output for the remainder of 1950 has already been sold to Southwestern and Midwestern municipalities and industry for the construction of water, gas and sewage systems.

Lone Star is constantly bolstering its place in the iron and steel industry by adding to its already vast reserves of raw materials. Within the last 60 days, 10 million additional tons of coal have been acquired, and a million tons of iron ore have been added to reserves within a few miles of the furnace.

Already a strong factor in the economic development of the Southwest, Lone Star is rapidly becoming a vital new source of material for the nation's defense effort. And interestingly, Lone Star pipe foundry can always claim priority on pig-iron for pipe from its sister blast furnace, less than a city block away.



Annealing Furnace

The pipe from the centrifugal casting machine spends 1½ hours passing through this annealing chamber, heated to 1750° F., in order to produce a pipe of tough wall structure free from stresses. From this chamber the pipe goes to the tar-dip vats or is cement or enamel lined as may be specified.

Centrifugal Pipe Casting Machine

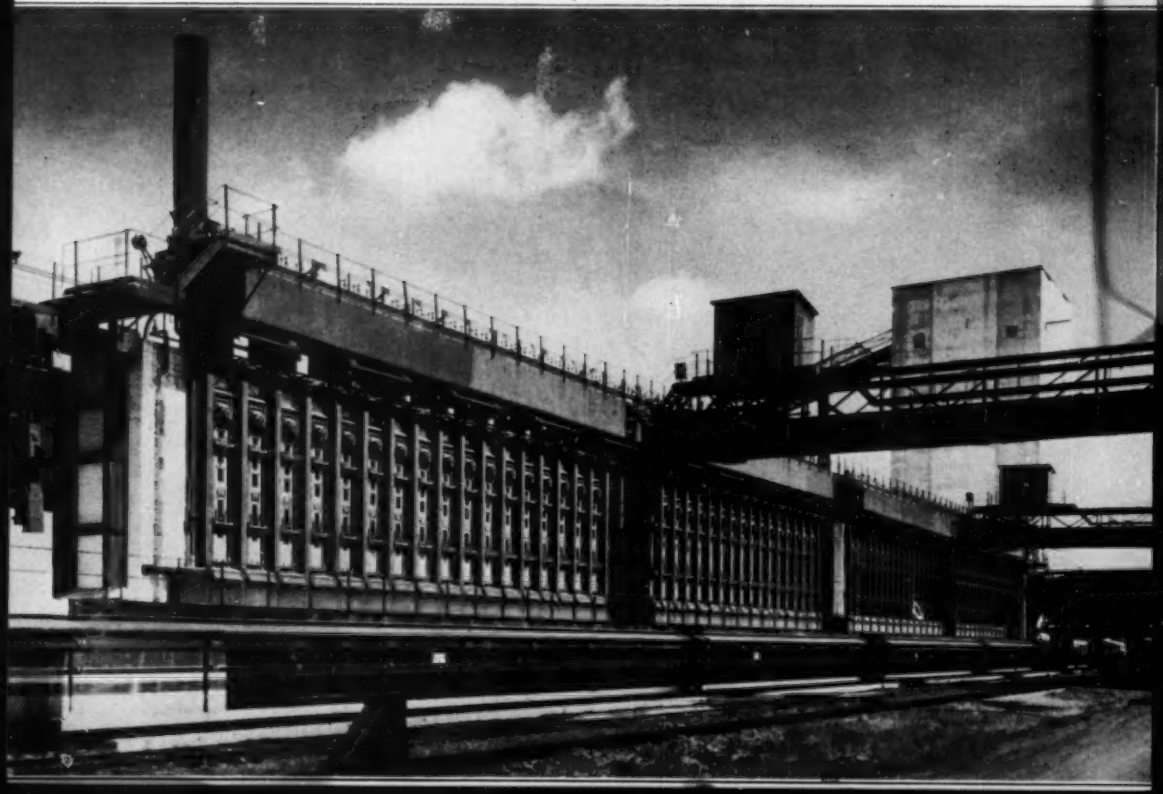
In the rear is one of the centrifugal casting machines which will turn out 3 to 20 inch pipe in the lengths up to 18 feet. In the foreground, left to right, are Lone Star's—

W. R. Bond,
Genl. Manager of Operations

Don Hooser,
Chief Plant Engineer

Wm. C. Fearn,
Supt. of Cast-Iron Pipe Plant

Lone Star's New Battery of 78 Kopper's Coke Ovens



SEWER MAINTENANCE AND CLEANING PRACTICES*

by
JOHN W. HOOD
Superintendent
SEWAGE TREATMENT
RIDGEWOOD, N.J.

CONVENTIONAL methods of cleaning and maintaining sewers and sewerage systems employing mechanical devices to aid in the removal of foreign materials and obstructions are well established and warrant only passing reference.

Improved tools have made the lot of the sewer maintenance man more tolerable, enabling him to accomplish more work in a given time than was formerly possible, and at the same time, making his task a decidedly more pleasant one. Water flushing is still an effective aid, whether automatic or manual.

Usually one finds the larger installations or systems, such as New York City, Chicago, Los Angeles and Baltimore, well organized and operated in respect of the care and maintenance of sewers.

The reverse is true of far too many of our smaller installations, and since these constitute, by far, the major part of our cleaning and maintenance problem nation-wide, it would appear profitable for us to explore the subject and reach some constructive conclusions.

The Author

Sewer Neglect

Neglect of sewer systems stems from two main causes, (a) economy, (b) practicality. Competition for funds at budget time all too frequently results in moneys being made available for more popular and tangible projects and functions of the average community. When budget paring and pruning has to be resorted to, the sewer maintenance appropriation is a favorite item for the pruning knife. This is more understandable when we realize again that popular belief has it that sewers, once built and being made of concrete, brick, vitrified tile and cast iron, somehow require little or no money spent on their upkeep and maintenance.

Too many towns impose practical limitations by assigning the care of the sewers to personnel already performing numerous other functions. Antiquated tools and a schedule which permits sewer cleaning only on infrequent occasions further contribute to the neglect of sewers.

Another contributory factor has been the long established practice of paying for sewage collection, pumping, and treatment from general taxes. Governing bodies usually regard this vital municipal function as a necessary evil and are reluctant to allocate more than the irreducible minimum to maintain these facilities. There is an increasing trend toward the adoption of sewer service charges as a solution of this problem, not only to meet operational expenses but also to provide for new and enlarged facilities.

Since sewage collection and treatment is of vital importance to the health and well-being of a community and its downstream neighbors, there seems no valid reason why the industry should not be put on the same sound fiscal basis which ensures the efficient and dependable operation of water utilities. However, public support for such a program would be difficult to generate and maintain since the average citizen really knows little or nothing of these matters and is not partic-

* Presented at the Amer. Pub. Wks. Assn. Public Works Congress, New York City Oct. 16, 1950 and here published by permission.

Trees Are a Source of Trouble in Lawns and Along Streets

Photo Courtesy of American City

Illustration of Actual Flow Obstruction in 48x118-in. Sewer

(Roots penetrated wall of sewer several feet above normal water level and caused sludge deposits.)

ularly interested in becoming educated. The exceptions, of course, are those who are sewer conscious because of stoppage in the house service and resultant cellar contamination. Some adult citizens are frank to state that they had never even given the matter a single thought.

Reasons for Sewer Cleaning

Before going futher, let us consider some of the reasons why a sewerage system should receive adequate cleaning and maintenance.

(1) Prevention of stoppages (from whatever cause) which create public health hazards by contamination of business and residential premises.

(2) Prevention of formation of noxious and lethal gases which are a threat of life and property, more particularly to maintenance crews.

(3) Protection of substructures and pipelines from deterioration by destructive biochemical processes which are induced by obstructed lines.

(4) Prevention of reduction in carrying capacities of pipelines.

(5) Prevention of enhanced biochemical oxygen demand of sewage resulting in sewage treatment difficulties and excessive costs.

(6) The abatement of stream pollution.

Stoppages

Since sewage is a liquid carrying suspended matter, stoppages may result from lack of sufficient velocity in pipelines to maintain solids in suspension. The unstable and decomposable character of these solids dictates the importance of free flowing lines. Scouring velocities are produced by adequate gradients and by the intermittent character of discharge from contributing buildings. Combined systems introduce increasing amounts of mineral matter and debris which require constant mechanical removal if serious interruption of sewer service is to be avoided. Separate systems usually experience grit deposition troubles in long flat graded lines. A more recent innovation for dealing with such problems is the "Sewer Ball" developed by the Sidu Corp. of Long Beach, California. It is operated by the upstream head of water and promises to simplify the problem of grit and sediment removal.

Roots and fungi are also common causes of obstruction but in practice are considerably more difficult to deal with by mechanical means. One Eastern U. S. city found its best efforts by mechanical means inadequate to deal with the problem of sewer lateral stoppages and the public demanded the removal of a large number of trees. In turn, it was found impossible to comply with even a small percentage of these requests.

The Amer. Pub. Wks. Assn. has available a Special Report No. 5, 1948 "Controlling Roots in Sewers by Copper Sulphate" which is based upon ten years successful work at Ridgewood, N.J., and discusses the root control problem and all its ramifications in detail.

Fungi are prolific in sewage collection systems and generally are found associated with reducing conditions. They obstruct free flow in pipes and contribute to the generation of lethal and explosive by-product gases from the sewage substrate. Carbon dioxide (the chokedamp of the mines) is evolved from the initial degradation of carbonaceous components present; hydrogen sulfide (H_2S) (or rotten eggs odor) from the breakdown or organic and inorganic sulfur compounds and methane CH_4 (Marsh gas or sewer gas) from the anaerobic decomposition of sewage solids; both of H_2S and CH_4 are lethal and dangerous when mixed with atmospheric oxygen in confined spaces such as manholes and partially filled pipelines.

Evolution of H_2S and CH_4 may be effectively controlled by maintaining root and fungi free conditions in the sewers, thereby preventing decomposition of sewage.

Baltimore, Md., has ". . . 40 men and 7 trucks constantly engaged in maintaining house connections and smaller sizes of lateral sewers and drains. They report the major cause of stoppages to be roots. Cleaning costs for house connections average $83 per mile or $16 per chokage."* Ridgewood, N.J., confronted by a similar problem on a smaller scale, adopted copper sulfate treatment in 1937 with excellent results both in sewer maintenance and sewage treatment.

Pump force mains, progressively restricted by fungi growths, increase friction head and decrease pump capacities. Teaneck, N.J., formerly spent $2000 per annum to clean force mains, now uses copper sulphate and eliminates both the expense and shutdown previously incurred.

Chemistry of Sewage

The chemistry of sewage being a specialized field is not generally known and understood. Hence, the

* Sewage Works Engineering, p. 407, Aug. 1942.

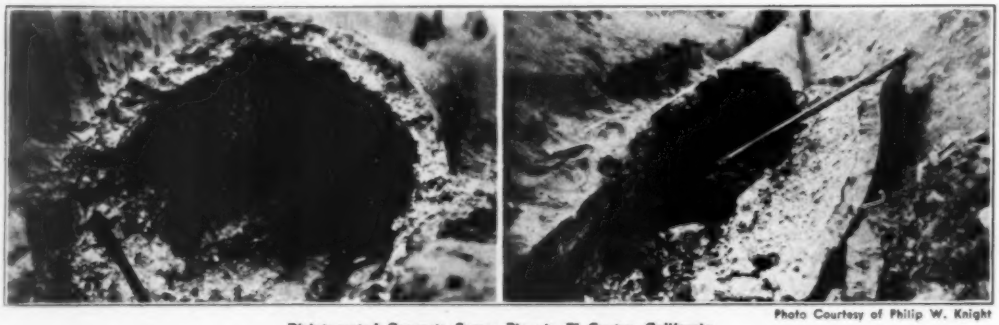


Photo Courtesy of Philip W. Knight

Disintegrated Concrete Sewer Pipe in El Centro, California

(Near Outlet) *(Along Outfall Line)*

relation between adequate sewer maintenance and the prevention of foul odors from dangerous gases; structural failures; and the increased stream and receiving waters pollution potential of sewage from unclean sewers, is not usually appreciated.

It can be scientifically and practically demonstrated that a clean, well-maintained system may be practically innocent of these undesirable evils while serving the same population and carrying the same or even greater volumes of sewage. Either pH and the methyl orange alkalinity or the Oxidation Reduction Potential or both may be employed to survey and determine maintenance and cleaning programs.

For example, using city water as a base, the alkalinity of a sewage will disclose the condition of a pipeline or system since decomposition enhances the alkalinity value by increasing the basic compounds. For example, given a city water of 80 ppm. M.O. Alk. and a street lateral sewage of 500 ppm. alkalinity, it can be stated that this sewer is badly obstructed. As cleaning work progresses, the sewage alkalinity will decrease. When it more nearly approaches the city water value, it may be safely assumed that the sewer is substantially free from obstruction.

Oxid.-Red. Potential

Controlled experiments have shown that O-R-Potential likewise may be used to survey and operate a system. This value denotes biological classification or various levels of electrical potential in the liquid at which entirely different organisms operate. For example, if a high positive potential is maintained in a line, then regardless of the concentration of organic or mineral sulphates present hydrogen sulfide will not be evolved and disintegration of structures will not occur. This is of prime importance in the operation of sewerage systems in the warmer regions such as our southern and western states.

Reinforced concrete pipes should not be used for sewers where control of O-R-Potential is not effected, if failures such as El Centro, Calif., experienced (see Phelps Dodge Booklet "Copper Sulphate for Root and Fungus Control in Sanitary Sewers and Stream Drains" 1949, p. 10) are to be avoided.

Some years ago, new sewage treatment facilities at Flora, Ill., could not be brought into successful operation. Investigations revealed the cause to be decomposing solids in the sewers. When the lines had been flushed, the treatment problems at the sewage plant ceased to exist, again proving the need for clean sewers.

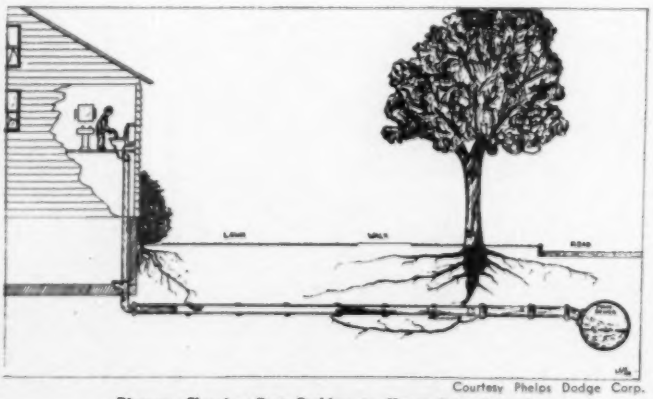
Summary

Millions of dollars invested in sewage treatment facilities are failing to produce optimum treatment results because of dirty sewers, thus contributing to stream and receiving water pollution and public health hazard. In addition, aerial nuisance and litigation resulting from uncontrolled odors and attendant deterioration of structures attend the operation of treatment plants receiving septic inflow.

The best interests of the public are to be served by adequate sewer maintenance. For reasons of economic and practical limitations, new tools and agents should be employed wherever possible to aid in this work particularly where severe problems exist. An educational program should be sponsored by the APWA and the FSWA to enlist the increased interest and support of both the governing bodies and the public at large for this vital phase of public service.

Acknowledgment

The author is indebted to *American City*, Village of Ridgewood; Phelps Dodge; and Philip W. Knight for the use of the illustrations.



Courtesy Phelps Dodge Corp.

Diagram Showing Root Problem in House Laterals and Method of Adding Copper Sulfate as Simple Means of Control

ADDITION OF GARBAGE TO SEWAGE

by

T. R. HASELTINE
THE CHESTER ENGINEERS
PITTSBURGH, PA.

THERE are four different ways by which garbage has been added to sewage. The oldest and most common method is the "lift the seat, dump and flush method," which has probably been in use ever since sewers and commodes were invented. That this method is extremely common is evident to anyone who examines the screenings or scum on a primary settling tank at almost any sewage treatment plant. The method is not scientific, however, and therefore we will dispense with any further discussion of the procedure.

Methods of Adding Garbage to Sewage

The three important methods of adding garbage to sewage are by central grinding stations with discharge to sewers, grinders at sewage plants with discharge to sludge digesters, and home grinders.

The first trial of central grinding stations was at Lebanon, Pa. in 1923. Since then such stations have been used at Baltimore, Md., Indianapolis, Ind., St. Louis, Mo., Gary, Ind., Lansing, Mich., Durham, N.C., Marion, Ind., and perhaps other places. The grinding stations have been located on trunk sewers either immediately ahead of the sewage treatment plant, or at more central locations throughout the city.

When the grinder is located at the sewage plant it has been found advantageous to discharge the ground material directly to sludge digesters, thus avoiding any effect on most of the other sewage treatment units. Both the advantages and disadvantages of this method will be discussed more fully later in this paper.

While central grinding stations may be of only theoretical interest to the operators of most sewage treatment plants, the last named method, namely domestic household garbage grinders, should be of interest to every sewage plant operator. The City of Butler, Pa., has an ordinance which prohibits the installations of these household grinders and I am told that Fond du Lac, Wis., is the only city west of Butler that has a similar ordinance. I mention this to demonstrate the apparent widespread acceptance of these units.

*Presented before the Pennsylvania State College Sewage Works School and here published by permission.

The Author

Central grinding stations will not eliminate the individual garbage cans or the disagreeable and unsightly parade of garbage collection. On the other hand domestic grinders will completely eliminate much of that odorous and fly beridden nuisance.

At one time human wastes were collected daily in wagons and hauled to points of disposal. Today, no civilized country would countenance such a procedure. Perhaps at some far distant time the attitude of the public to garbage collection will be the same as is the present day public's attitude to the collection of human wastes. When that time comes, domestic garbage grinders will no doubt be as universally used as is water carriage of human wastes today. However, I believe that time to be in such a far distant future that present day designers or operators need not be concerned about the use of garbage grinders in more than half of the homes.

Central Grinding Stations

The grinders used at central grinding stations are of two types, either the hammermill type, as manufactured by the Jeffrey Manufacturing Co. and Gruender, or the rotary shear type, as manufactured by Mitts and Merrill. Power consumption varies with the fineness of the grind. Early experiments with some of these units only attempted to grind the garbage so it would pass a ¾-in. mesh screen. However, experience indicated that a finer grind was desirable and now, so far as the writer knows, present day units attempt to grind all material so it will pass a ¼-in. mesh screen. Power consumption ranges from 4 to 5 kilowatt hours per ton of garbage ground. Jeffrey makes five different sizes of units ranging from 2½ to 30 tons per hour in capacity. The smallest unit is powered by a 10 horsepower motor and the largest unit by a 100 horsepower motor. The smallest Gruender grinder has a capacity of 6 tons per hour and is powered by a 30 horsepower motor. The Mitts and Merrill grinders range in capacity from 6 to 24 tons per hour and have motor sizes ranging from 40 to 150 horsepower. All three makes have provisions for segregating tramp metal. However, tin cans are not included in this category, and are cut up with the wet garbage in event they enter the units. Grinders of the hammermill type have difficulty in handling such material as corn husks or poultry feathers.

Water is added to assist in flushing the ground materials through the machine, as is the case of the domestic grinders. Water consumption ranges from 500 to 700 gallons per ton of garbage ground, depending upon whether the units are operating at below capacity, or their rated output.

C. E. Keefer of Baltimore, Md. states that the noise created by central grinding stations can be heard for distances of 400 to 500 feet, but concludes that the odor nuisance from such stations is much less than that from either incineration or garbage reduction.

Domestic Grinders

Although the General Electric Co. "Disposall" is the best known household garbage grinder, there are more than a dozen different manufacturers of kitchen garbage grinders and at least four manufacturers of units for restaurants and hotels. Several of the household type manufactures are licensees of General Electric. Specifications for one of these household units supplied by one of the manufacturers include the following:

"The food waste shredder shall discharge shredded wastes at a reasonably uniform rate, in a fluid form, which shall flow readily through an approved trap, drain line or soil line in a manner which will prevent clogging or stoppage of drain line. The food waste shredder shall shred food waste to a uniform size to meet the following requirements: 100 per cent shall pass ½-in. screen, at least 90 per cent shall pass a ¼-in. screen, not over 5 per cent shall pass a No. 40 sieve. Screens shall be the U. S.

Standard and weight shall be taken on a dry basis."

The units handle about one pound per minute of ordinary household garbage. During grinding, water is added at the rate of 1½ to 2½ gpm.

It has been suggested that as home grinders develop in popularity, ordinances prohibiting their use will be as difficult to enforce as are our present ordinances prohibiting the introduction of roof drainage into sanitary sewers. At present, these domestic units are still too high priced to be installed in any but the more expensive homes. However, many people expect that their use will some day become as widespread as our electric refrigerators today.

In the May, 1949, issue of *Water & Sewage Works*, Mark Owen traces the development of radios, refrigerators, automobiles and similar units and draws a comparison between those units and domestic grinders. It is his estimate that by 1965 domestic grinders will be used in approximately 45 per cent of the homes, and that from then on their usage will increase until they will be found in from 50 to 60 per cent of the homes. It should be noted, however, that radios, electric refrigerators and automobiles are still not used in all homes, and therefore, unless home grinder use is made compulsory, there is no reason to expect that household grinders will ever be universally used.

Quantity and Character of Garbage

It must be borne in mind that only wet, or green, garbage can be added to sewage. It should preferably be unwrapped, relatively free from paper, and fit to feed hogs. Ramsey states that in an average city wet garbage constitutes 65 per cent of the total tonnage of refuse. At Los Angeles, where there are little or no ashes, and combustible refuse is not collected, wet garbage constitutes 77 per cent of the total tonnage of refuse collected. Thus it appears that we would still have dumps and periodical visits of the rubbish man, even though domestic garbage grinders were universally used.

Before considering the effect of the admission of ground garbage to sewers or sewage treatment plants, it is necessary to have some idea of the amount of such garbage that might be added. A rather extensive review of the literature indicates that the average annual production of green garbage ranges from about 0.4 to 0.8 lb. per capita per day. Some of this variation may be due to variations in moisture content, which has been variously reported from 60 to 98 per cent. For the purposes of this discussion I have assumed a per capita green garbage production of 0.6 lb. per day, containing 75 per cent moisture.

The per capita production of garbage is subject to greater seasonal variations than is the per capita production of sewage solids. For example, at Columbus, Ohio, where the average production of garbage was 0.68 lb. per capita per day, over a 12 year period, the peak for a 30 day period during that time was 1.37 lbs. Maximum production occurs during the summer when green vegetables are most plentiful and usually is at a minimum during the month of February.

The literature contains numerous analyses of garbage, many of which do not agree. This is not surprising; in fact, there is no more reason to expect various analyses of garbage to agree than there would be to expect various analyses of sewage or sewage sludge to agree. In the accompanying table is presented more or less typical analyses of all three substances:

Comparison of Character of Garbage with Sewage and Sludge

	Pounds Per Capita Per Day		
	Ground Garbage	Sewage	Primary Sludge
Total Solids	0.15	0.55	0.12
Total Volatile Solids	0.13	0.32	0.08
Suspended Matter	0.10	0.20	----
5 Day B.O.D.	0.08	0.17	----
Fats and Greases	0.03	0.05	0.03
Nitrogen	0.002	0.04	0.003
Moisture	0.45	----	2.28
Total (Moisture + Total Solids)	0.60		2.40

Even a casual inspection of that table must make it evident that the universal admission of ground garbage to sewage is bound to materially increase the burden on sewage treatment plants or receiving streams. The table is somewhat misleading in that the figures for ground garbage are based upon the assumption that the garbage is ground without the addition of water, while as above stated, this is not the case, either for domestic grinders or for central grinding stations. Water consumption with domestic grinders ranges between 1 and 2 gallons per capita per day. The water consumption of central grinding stations averages about the same, if it is assumed that 0.6 of a pound of green garbage per capita is produced and that water consumption ranges from 500 to 700 gallons per ton of garbage ground. This water dilutes the garbage so that instead of having an initial solids content of 25 per cent as assumed in the accompanying table, it would have a solid content of only about 7 per cent.

Effect of Garbage on Sewage and Sewers

The figures in the table indicate that if all garbage from a community were ground and added to the sewage, that the suspended matter and B.O.D. of the raw sewage would be increased approximately 50 per cent. Since domestic grinders will not be located in all of the homes, the increase resulting from their use will be proportionately less. However, the information previously given on water usage indicates that even were all garbage of a community to be ground, either by domestic grinders or in central grinding stations, the quantity of sewage would be increased only about 1 or 2 per cent, (based upon an assumed sewage flow of 100 gallons per capita per day). Thus it is evident that so far as size or capacity of sewers is concerned, the grinding of garbage and deposition into those sewers will have no effect.

Experience with domestic grinders has shown that the admission of finely ground garbage to house plumbing does not cause clogging in them; in fact, there is a tendency for the garbage to keep the inside of the pipes clean.

Normal domestic sewage and most industrial wastes are extremely dilute. For example, a flow of 100 gallons per capita, containing 0.2 of a pound of suspended matter would have a suspended solids content of 250 ppm. Even if all garbage were ground and added to the sewers, the suspended solids content would only be about 360 ppm. In the design of sewage structures, engineers apply the same laws of hydraulics to the flow of sewage as are applied to the flow of water. Water which carries suspended matter continues to flow as water until the concentration of suspended particles become so great that they touch one another in the fluid.

Sewage is so dilute to start with that it does not seem possible that a 50 per cent increase in suspended solids would cause any more deposition than occurs in normal sewage. Therefore, if a sewer system is free from deposits before the admission of garbage, it is reasonable to expect that it will remain so after the addition of ground garbage. However, if troubles are now experienced with deposition of sewage solids in certain portions of a sewer system, the addi-

tion of ground garbage may be expected to increase the amount of deposition at those particular localities.

Furthermore, inasmuch as garbage is higher in volatile solids than is sewage, the volatile content of those deposits would be increased, thus increasing the putrescibility and the likelihood of creating obnoxious odors. The necessity for flushing sewer systems would be increased and, in event the frequency of such flushings was not stepped up, sewage reaching the treatment plant would be more septic than it had been in the past. These troubles might warrant the exclusion of ground garbage from sewage collection systems. The blame, however, should not be placed on garbage grinders or garbage, but upon the inherent faults in the design or construction of the sewage collection system.

Even well designed sewer systems are troubled with deposition of solids at the upper ends of laterals where the volume of sewage is too small to maintain adequate depths of flow and hence solids become stranded along the pipe. It is to be expected that if domestic grinders are installed in homes tributary to the upper ends of these lateral sewers, that such difficulties will be increased. Flushing would be the only remedy.

After considering all of these factors, it seems reasonable to conclude that there should be no objections to the admission of properly ground garbage to a well designed and constructed separate sewer system. Such may not be the case with a combined system. Most combined systems are designed with storm water overflows which come into operation whenever the total flow exceeds 2 to 3 times the peak dry weather flow. The theory being that the overflow at that time is so low in suspended solids and B.O.D. that it has no deleterious effect upon the receiving stream which presumably is also a flood stage. If, however, all the garbage of the community has been ground and added to this sewage, then its B.O.D. and suspended solids content will be increased 50 per cent, and hence the B.O.D. and suspended solids content of the storm overflow would be correspondingly increased. Whether or not such an increase would cause objectionable conditions in the receiving stream is a matter for individual study in each locality.

Effect of Garbage on Grit

Now let us consider the possible effect of the addition of ground garbage to sewers upon the various sewage treatment plant structures. First let us consider grit chambers. Carpenter, et al, states, "that where the municipality collects the refuse, it will be difficult to educate householders to separate the garbage from foreign materials. In cities where garbage is disposed of by feeding to hogs or reduction, large amounts of metal and glass are found in the garbage. Unless such materials are removed before the garbage is ground, grit chambers in existing plants may have to be extended."

At Indianapolis, where all garbage was ground and discharged into the sewage for seven months, the garbage was hand picked for tin cans, heavy bones and large pieces of metal. The picked material constituted 3.1 lb. of bones and 3.4 lb. of metal per ton of green garbage. Despite this hand picking, the garbage produced 38.2 lb. of grit (containing 28 per cent water) per ton of green garbage. This constituted an average increase of 23 per cent in grit collections for the Indianapolis plant. Green garbage collections at Indianapolis amount to only 0.43 lb. per capita per day. In cities where the quantity of garbage is higher, the amount of grit will also be higher. On the basis of 0.6 of a lb. of green garbage per capita, the increase in grit might have been 35 instead of 23 per cent.

At Finley, Ohio, where a central grinding station is used, garbage additions are made at the rate of 1.1 ton per million gallons of sewage. Prior to operation of the grinding station, grit collection averaged 1.5 cu. ft. per mil. gal. of sewage, while since the operation of the grinding station, they have averaged 2.7 cu. ft., thus indicating an 80 per cent increase in amount of grit.

Garbage grit is largely bones, egg shells, etc. Its volatile content is higher than that of good grit and frequently it is much more offensive. Experience at Indianapolis showed that by grinding to pass ¼-in. mesh instead of ¾-in. mesh that the offensiveness of the grit could be materially reduced. The use of grit washers will probably be found more necessary if central grinding stations are installed on trunk sewers.

It is to be expected that less grit will result from the grinding of garbage in domestic grinders than would be the case where central grinding stations are used. This statement is based upon the observation that it is just human nature to take better care of your own garbage grinder unit that you have paid for out of your hard earned money, than it is to worry about including large bones or tin cans in so-called green garbage which is to be delivered to the city's grinder.

Effect of Garbage on Sedimentation

The addition of ground garbage to sewage may affect the performance of primary settling tanks in three different ways: (a) the amount of scum produced, (b) tank efficiencies and quality of effluent, and (c) the kind and amount of sludge collected.

Experience has shown that the addition of ground garbage definitely increases the amount of scum forming on the top of primary tanks. However, the more uniform the additions of garbage and the finer its grinding, the less serious becomes the scum problem. It is generally recognized that all primary settling tanks should be provided with mechanical skimming devices. If this is done and garbage additions are made at the uniform rate, or as uniform as might practically be obtained, it is not to be expected that the increase in scum formation will be serious. Screening of settled sewage through ¼-in. mesh screen might be advisable to prevent floating solids causing trouble with secondary treatment devices. This scheme is now used at a number of sewage plants, particularly those having comminuters or bar screenings shredders, and causes no undue difficulty in operating problems.

As regards settling tank efficiencies, all investigators seem to agree that the addition of finely ground garbage increases the percentage removals of both suspended solids and B.O.D. by plain sedimentation, but there the similarity in published results ends. One investigator reports that these percentage increases in removals are so great that they completely offset the increase in solids and B.O.D. of the raw sewage, and therefore the settling tank effluent actually has as low, or a lower, B.O.D. content than it did prior to the introduction of garbage. Another investigator, however, reports that the addition of ground garbage to sewage may increase the B.O.D. of the settled sewage as much as 100 per cent. Most of these investigations were made on laboratory or small pilot plant scale. Results from existing sewage treatment plants are difficult to interpret because frequently the addition of ground garbage was not the only change made at the sewage treatment plant. Frequently central stations were constructed at the same time that secondary treatment processes were installed and thus return of secondary sludge or changes in the character of digester supernatant being returned to primary tanks might well account for some of the changes observed in the quality of settled sewage.

After reviewing all of the available literature, the writer has come to the

conclusion that the addition of ground garbage to sewers ahead of the primary settling tank may result in a 5 to 10 percent increase in the suspended solids content and a 15 to 30 per cent increase in the B.O.D. of the tank effluent. These figures apply to a municipality where all green garbage is ground. Obviously if domestic garbage grinders are installed in only a few of the homes, the resulting increase will be correspondingly less, and in fact, may be so small that it cannot be observed until such time as those grinders become more universally used.

As regards volume of sludge collected in primary settling tanks, the literature seems to indicate that in general the garbage solids have settling characteristics similar to those of the sewage solids and that therefore the solids content of the primary sludge will be about the same after the addition of ground garbage that it was before. Because of the increase in total solids, however, there will be a corresponding increase in volume of sludge. In fact, as the figures in the table on garbage characteristics would indicate, and as confirmed by several statements of various investigators, it appears reasonable to expect that the volume of sludge would be increased 100 per cent as a result of ground garbage additions from the entire community. Since the garbage solids are higher in volatile matter than are the sewage solids, the increase in volatile content of the sludge will be even greater, perhaps 150 to 175 per cent.

Effect of Garbage on Chemical Treatment

When garbage is ground much of the matter which was originally in suspension goes into either true solution or colloidal dispersion. The more distant the grinding point above the sewage plant, the greater will be the amount of material dissolved. Rudolfs has found that actually a considerable portion of this dissolved material is in true solution rather than colloidal dispersion and as such is not amenable to chemical coagulation. Therefore, chemical precipitation will not effect a B.O.D. reduction as great on mixtures of sewage and ground garbage as it will on sewage alone.

Rudolfs also found that the addition of ground garbage to sewage increased the amount of chemicals required for coagulation. When iron salts were used as the coagulant, the addition of garbage always increased the iron demand at least 5 to 10 ppm. The importance of pH adjustment with iron appeared more pronounced in sewage garbage mixtures than in sewage alone. Optimum coagulation occurred at a pH of 8.5 to 9. On the other hand, where alum was used as the coagulant, the addition of garbage to the sewage made less difference in the chemical demand. Optimum coagulation was at a lower pH.

Effect of Garbage on Secondary Treatment

In general, grit chambers and primary settling tanks are designed on the basis of sewage volume and since the addition of ground garbage makes very little increase in volume of sewage, little or no change in these structures are required to adopt them to sewage garbage mixtures, even though operating problems such as sludge quantities, grit quantities, or chemical coagulant requirements may be increased by the addition of ground garbage.

Now let us consider secondary or oxidizing methods of sewage treatment. Since the addition of ground garbage increases the B.O.D. of either settled or chemically coagulated sewage, and since these oxidizing treatments are designed partly, at least, on the basis of B.O.D. loading, it seems obvious that secondary treatment structures must be increased if ground garbage is to be added to the sewage. Obviously, the amount of increase is dependent upon the amount of garbage added. The effect of these additions of ground garbage upon the activated sludge process has been reported by a number of investigators. All seem to agree that the oxygen demand resulting from the addition of garbage is just as readily oxidized as is the normal oxygen demand of the settled sewage. They also agree that the addition of ground garbage does not interfere with nitrate production and that, providing aeration periods and air usage are adequate, it has no deleterious effect upon settling or oxidizing characteristics of the activated sludge itself.

Tolman has concluded that the addition of ground garbage to raw sewage would increase the required capacity of aeration tanks for the activated sludge process by 5 per cent, and the quantity of air required by 11 per cent.

Less research has been done on trickling filters. It is generally agreed, however, that the organisms responsible for oxidation on trickling filters are the same as those responsible for oxidation in the activated sludge process. Therefore, it seems logical to believe that mixtures of ground garbage and sewage may be as easily treated on trickling filters of adequate size as mixtures can be treated in suitable activated sludge plants. It is quite possible, however, that floating solids resulting from increased scum formation on primary tanks might cause difficulties with nozzle clogging on trickling filters unless screens are injected between the primary tanks and the filter distributors.

Where only primary treatment is practiced, the receiving stream is actually the secondary treatment or oxidizing unit of the complete sewage disposal system. Obviously, increases in B.O.D. or suspended solids of the settled sewage place a greater burden on the receiving stream. Whether or not it can handle that burden is a problem for local investigation in each case.

Effect of Garbage on Sludge Digestion

Repeated laboratory studies have shown that the organic matter in garbage is digestible regardless of whether such material is digested alone or mixed with sewage sludge. Experiments on the digestion of garbage solids alone indicated that there was a tendency for the formation of acid conditions and that frequently the pH dropped so low that digestion was seriously retarded or inhibited.

Inspection of the table of analyses previously given indicates that nitrogen constitutes only about 1.5 per cent of the volatile matter in garbage, as compared with almost 4 per cent in primary sewage sludge. Quite possibly there is not enough nitrogen in the garbage to maintain the necessary alkalinity for good digestion. In the case of digestion of a garbage-sewage sludge mixture, although the nitrogen to volatile matter ratio is considerably lower than it is in the sewage sludge alone, it is apparently high enough so that little or no difficulty is encountered in maintaining suitable alkalinity and pH for sludge digestion.

Ground garbage has been successfully digested with sewage sludge in ratios varying from 0.3 up to 1.5 parts of dry volatile garbage solids per part of dry volatile sewage sludge solids.

Data indicate that at least 16 cu. ft. of gas may be expected per pound of volatile garbage solids digested. This compares with estimates of 15 to 18 cubic feet per pound of volatile sewage solids digested. As might be expected, the optimum temperature for digestion of sewage garbage mixtures is the same as for the digestion of sewage solids alone. Babbitt had little or no success in digesting garbage sewage mixtures in unheated Imhoff tanks during the winter months, but was quite successful in digesting it in heated separate digestion tanks. Obviously, seeding and mixing of incoming raw sludge with actively digesting material is just as necessary

when digesting the mixtures as it is when digesting sewage sludge alone, but again there seems to be considerable difference of opinion as to whether or not mechanical mixing and stirring devices are necessary and if so, which type of device is best suited to the problem.

While there is every reason to believe that garbage may be successfully digested when mixed with sewage or sewage sludge, it does not follow that the addition of garbage to sludge digestion facilities already operating under a heavy load would cause no serious difficulty.

In the operation of sludge digestion tanks, there is no single unit by which the loading on a particular tank can be measured. Loading is a function of both the volume of the raw sludge, and the weight of dry volatile solids introduced into the tank. Obviously more volatile garbage solids will require digestion if the ground garbage is discharged directly to the digester than if it is discharged to the trunk sewer.

Various investigators have reported that when the ground garbage is fed to the sewage, the quantity of garbage reaching the digester will vary from 40 to 75 per cent of the total garbage additions. If we assume this percentage to be 67 per cent, then it is obvious from the foregoing table that the direct addition of ground garbage to the digester would increase the quantity of dry volatile solids to be digested 163 per cent as compared with about a 100 per cent increase if the ground garbage was added to the raw sewage ahead of the grit chamber.

On the other hand, even when allowance is made for the addition of water during grinding, the ground garbage will contain 7 per cent or more, solids as compared with 4 to 5 per cent solids in normal primary sewage sludge. Therefore, the total volume of raw material charged to the digester will be no greater if all garbage were ground and delivered directly to the digester than it would be were the garbage delivered to the raw sewage, and only the settleable portion removed from the primary tanks to the digester. On the basis of the previously given analysis, these volumes would be almost identical; many investigators claim that there is actually a reduction in volume of material charged to the digester when the ground garbage is delivered directly to those tanks.

In any specific instance, complete information on the quantity and character of both the local garbage and sewage should be obtained before deciding upon the digestion capacity required for handling the mixed garbage-sewage sludge, but in general, the addition of all of the garbage of a community will approximately double the digester capacity that would be required for digesting sewage sludge alone. At complete sewage treatment plants, where digester capacity is considerably higher due to the necessity of digesting secondary as well as primary sludge, the addition of garbage would not necessitate such a big percentage increase in digester capacity.

Although the digester capacity required for handling garbage-sewage sludge mixtures will be about the same regardless of whether the ground garbage is added directly to the digester or to the raw sewage, it should be noted that the quantity of gas to be expected from such digestion will be considerably greater if the garbage is added directly to the digestion tanks. Assuming the same degree of digestion in either case, this increase might be 30 per cent.

Lansing, Mich., was one of the first municipalities to adopt the practice of grinding all green garbage and discharging it directly to sludge digesters. Delivery of ground garbage was made by pneumatic ejectors. The plant was completed early in 1938 and included the activated sludge process, as well as primary sewage treatment and garbage grinding. Soon after it went into operation considerable difficulty was encountered with the deposition of grit in digested sludge lines and the clogging of ball valves on digested sludge pumps. This grit resulted from the grinding of bones, egg shells, fruit pits and bottle caps originating in the garbage. The operators found it necessary to flush all digested sludge lines daily and each day removed about 15 to 20 cu. ft. of such garbage grit from those lines. As a result of that experience, most plants handling ground garbage now either discharge that material to the sewage ahead of the grit chambers, or provide special facilities for removing the garbage grit before it is introduced into the digester. However, ground garbage has been successfully handled in the digestion tanks at Goshen, N.Y., without prior removal of garbage grit. There the digestion system is of the two stage type. Ground garbage is delivered directly to the primary digesters by pneumatic ejectors. When sludge is transferred from the primary to the secondary digester it first passes through a manhole before entering a second ejector. Whenever the operator believes it is necessary, he places a wire mesh screen at the point where the primary digester discharge line enters the manhole and in this manner removes the larger inorganic solids. This is done occasionally and is not a regular routine procedure.

Henry Taylor, designer of the plant, believes that the removal of garbage grit is unnecessary if a blow-off head of at least 10 ft. is provided at the primary digester sludge draw-off line and if facilities are provided between the two digesters for removal of the coarser, non-organic material.

Two methods have been used for removing grit from ground garbage before it is introduced into the digestion tanks. The method used at Marion, Ind., provides for the delivery of ground garbage to a pit where water is added to bring the solid content down to approximately 5 per cent. The contents of the pit are then agitated with compressed air which washes the garbage, causes most of the organic matter to float, while still permitting the grit to settle to the bottom. After a few minutes of such agitation all of the contents of the tank, except the deposited grit, is pumped to the digesters.

The other method that has been used is to pass the ground garbage through a grit washer similar to the Jeffrey jig-grit. The overflow from such units, which includes most of the organic matter in the garbage, passes to a wet well from which it is pumped to the digesters. While either of these methods is successful in eliminating grit from the ground garbage, both of them dilute it with additional water so that the material delivered to the digester contains only 4 to 5 per cent solids instead of perhaps 7 to 10 per cent solids that might have been obtainable had grit removal not been considered necessary. Obviously this materially increases the volume of raw sludge delivered to the digester and therefore produces an additional burden on sludge digestion and increased digester overflow liquor. In fact, the solid content of the deliveries to the digester in this case would be no greater than it would be had the ground garbage been delivered directly to the raw sewage ahead of the main grit chambers. Therefore, the only advantage gained by direct additions of garbage to the digester in this manner is the elimination of the previously mentioned effect of ground garbage on chemical precipitation or oxidizing processes of secondary sewage treatment.

Effect of Garbage on Sludge Drying

Rudolfs has investigated the dewatering of fresh and digested sewage and sewage-garbage sludges on vacuum filters. He concluded that fresh sludge from sewage-garbage mixtures can be readily dewatered on vacuum

fitters with the aid of ferric chloride before or after digestion. The ease of dewatering such sludges after digestion appears to depend on the same factors which determine the rate of dewatering digested sewage solids alone.

In general, all investigators agree that digested sewage-garbage sludge has the same general characteristics as digested sewage sludge, and all experiences indicate that it may be as easily dried on either vacuum filters or sludge drying beds as can be the digested sewage sludge alone. It should be obvious, however, that sewage plants handling ground garbage will require larger drying facilities than would be the case if they received no garbage at all. Even though garbage is high in volatile solids, not all of that volatile matter will be digested and therefore there will be a very material increase in quantity of digested sludge to be dried.

Conclusions

In conclusion, it may be stated that garbage may be ground and added to sewer systems without creating any serious problems, providing such systems, including the collection system as well as the treatment plant, are adequately designed and constructed to receive such material. Where collecting sewers are already subject to solids deposition and putrefaction, or where sewage treatment facilities are already operating at close to maximum capacity, a municipality may be entirely justified in making every effort to exclude garbage from its sewer system.

So far as central grinding stations are concerned, it is obvious that they should only be installed after careful consideration of the condition of the existing sewerage system and the costs of enlarging and operating that system to handle the garbage has been compared with the cost of constructing and operating incinerators or other methods of garbage disposal equally satisfactory from a sanitary viewpoint. So far as domestic garbage grinders are concerned, one may expect it to become increasingly difficult to prevent their installation as the public becomes more familiar with their convenience, and more widespread use results in decreased initial cost of household grinders. Therefore, designers and all others charged with the maintenance or operation of sewer systems, should recognize the probability of gradual increases in sewage treatment loads that are likely to result from the widespread use of these units.

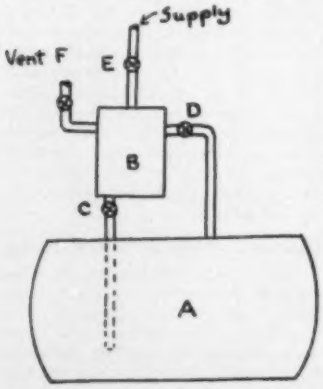
Although existing sewage treatment plants can be altered or enlarged if necessary to facilitate the handling of ground garbage, the same cannot be said for the ability of a receiving stream to handle an additional load of pollution. Thus, it is conceivable that in some cases the admission of ground garbage to the sewage system will necessitate a higher degree of treatment than would be the case if garbage were disposed of by incineration or some other method.

In event the use of central grinding stations is under consideration, the question will naturally come up as to whether such stations may be better placed at the sewage treatment plant or at some more central location providing shorter hauls by the garbage collection vehicles. Time does not permit mention of all of the factors to be considered in arriving at such a decision. I do wish, however, to call attention to one factor which might be overlooked. The practice of using sludge digestion gas for power generation is well known and as the previous discussion pointed out, the addition of garbage to sewage might more than double the amount of gas available for power production, heating and the like. In the writer's opinion, the power to be obtained from such gas might better be used for operating pumps, blowers, or other units that operate practically continuously, than for driving garbage grinders that operate only intermittently. Garbage grinders have extremely large motors. The starting of such large motors would create excessive loads on generating equipment that might otherwise be large enough to supply the power required at the treatment plant.

How to Feed a Boiler Without a Pump or Injector

This sketch shows how water can be fed into a boiler under pressure without the use of a pump or injector of any kind.

"A" is the boiler that is to be fed. "B" is a tank or vessel capable of withstanding the steam pressure of the boiler itself. Close valves C and D and open valve E and vent F so that tank B will fill with water through the supply pipe. Then close valves E and F and open valves C and D. Steam will enter B through the valve D and the water from B will flow downward through D due to gravity because the vessel B is now nothing more or less than a part of A., and, since water naturally seeks its level in pressure vessels as well as in the open atmosphere, it will flow downward, B will empty, and the water level in A will be raised. After B is empty close C and D again and open E and F and repeat the above process.



It is well to note in this connection, however, that some steam is required to do this work. When all of the water is emptied out of B that vessel is full of steam, hence the volume of steam used is equal to the volume of water fed into the boiler. It is therefore a simple matter to compute, roughly, the amount of steam required to feed a given quantity of water into a boiler with this apparatus.

*Contributed by W. F. Schaphorst, M.E., Newark, N.J.

"Ah! Ha! I always suspected our City Reservoir had fish in it."

MILK WASTE TREATMENT ON AN EXPERIMENTAL TRICKLING FILTER

by

EARNEST F. GLOYNA
Assistant Professor
UNIVERSITY OF TEXAS
AUSTIN, TEX.

ALMOST any industrial waste may cause stream pollution and one of the most common of all industrial waste disposal problems is that occasioned by milk wastes. This problem of dairy waste disposal has become so important that the Sanitary Standards Subcommittee of the Dairy Industry Committee (a national organization) has appointed a Task Committee whose duty is to collect and distribute information on this subject. This action by the Dairy Industry is endorsed by the Federal Water Pollution Control Advisory Board.

Professor Bloodgood [2] in his comprehensive review of "Milk Waste Disposal" states that milk plants processing 500,000 pounds of milk per day are common. He also tells us that the Purdue Laboratory reports finding total solids in whole milk in the amount of 131,500 ppm., or about 0.002 gallon of milk to be equivalent to a gallon of domestic sewage. Products of milk, along with all of its suspended matter, are considered to be a suitable medium for the growth of organisms. The resultant products of decomposition then usually have a noxious effect upon the surrounding locality, and these conditions always lead to very disagreeable circumstances for everyone concerned. The recovery of pollutional by-products in industry blesses the manufacturer either in net returns on his investment, or by the good will of his down stream neighbors and freedom from governmental interference.

The causes of the milk pollutional problem are many; however the necessity of treating wastes containing milk has been in most cases occasioned by the consolidation of milk processing plants. Milk wastes which find a way to the sewer or stream generally come from two major sources, namely from can drippings and from the combined losses, as discussed in Bulletin No. 2 of the Milk Industry Foundation. The former is the least in quantity but is also an unknown factor for it is generally not weighed. E. F. Eldridge [3] points out in his article on "Dairy Waste Disposal" that there is no legitimate reason for a wide variation in the amount of waste from milk plants. Yet, in many plants, the pounds of B.O.D. vary so greatly from one day to another that it is impossible to design an economical treatment plant.

The Author

Waste Prevention

The first item of a waste disposal program should be waste prevention, because the average milk plant will

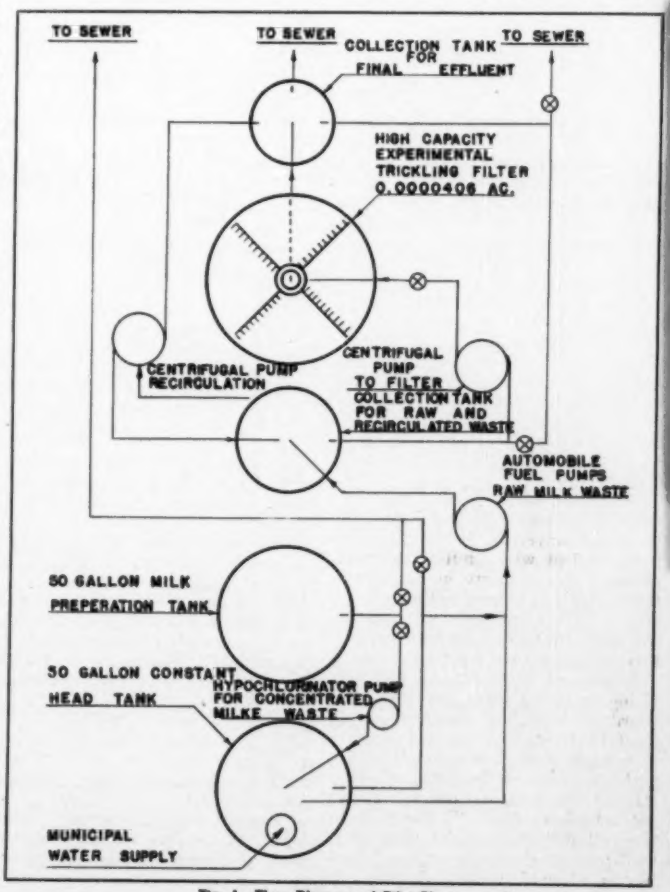

TO SEWER
TO SEWER
COLLECTION TANK FOR FINAL EFFLUENT
TO SEWER
HIGH CAPACITY EXPERIMENTAL TRICKLING FILTER 0.0000406 AC.
CENTRIFUGAL PUMP RECIRCULATION
CENTRIFUGAL PUMP TO FILTER
COLLECTION TANK FOR RAW AND RECIRCULATED WASTE
AUTOMOBILE FUEL PUMPS RAW MILK WASTE
50 GALLON MILK PREPERATION TANK
50 GALLON CONSTANT HEAD TANK
HYPOCHLORINATOR PUMP FOR CONCENTRATED MILKE WASTE
MUNICIPAL WATER SUPPLY

Fig. 1—Flow Diagram of Pilot Plant

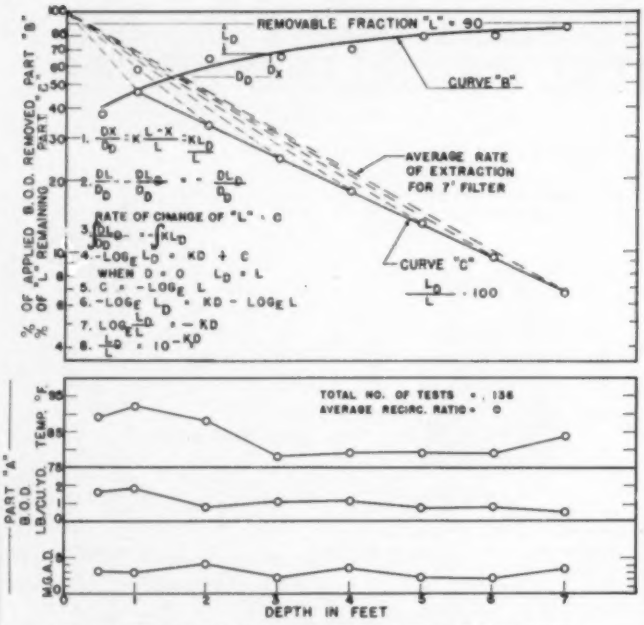

REMOVABLE FRACTION "L" = 90
CURVE "B"
AVERAGE RATE OF EXTRACTION FOR 7' FILTER
CURVE "C"
RATE OF CHANGE OF "L" = C
WHEN D = 0 L = L
% OF APPLIED B.O.D. REMOVED, PART "B" % OF "L" REMAINING, PART "C"
TOTAL NO. OF TESTS = 136
AVERAGE RECIRC. RATIO = 0
PART "A" B.O.D. LB./CU.YD. TEMP. °F
M.G.A.D.
DEPTH IN FEET

Fig. 2—Performance of Low-Capacity Trickling Filter—No Recirculation

of these processes have failed due to excessive costs or improper operation. The trickling filter has proven to be the most successful process. Barritt [1] indicates that the relationship between milk wastes and domestic sewage are as follows:

"Milk wastes contain varying amounts of fat, protein and sugar, all of which are found in domestic sewage, and are readily decomposed by bacteria. The proportion of sugar to protein is much higher than in sewage. A high sugar content in relation to the nitrogen retards the purification, requiring a longer time of contact, and the addition of sewage or ammonia would be helpful in the case of whey."

The chemical problems presented by the carbohydrate lactose in milk, not generally present in domestic sewage, seems to have an effect upon the nitrification; far better nitrification can be obtained when lactic acid bacteria are least numerous [2].

Experimental Studies

The whole subject of high-capacity and low-capacity trickling filters, along with the factors connected therewith, have been discussed and

contribute wastes equivalent to several thousands of population. The Task Committee of the Dairy Industry has made specific recommendations on how to undertake a waste prevention program as a logical part of plant operations. This waste prevention in the dairy industry may accomplish two desired results. First, the milk solids normally lost to the drainage system may be recovered and turned into a profit to the industry, and secondly, the pollution of streams and nuisances created by the decomposition of milk solids may be reduced. The latter part of this statement is very important. The measurement of the volume and the strength of waste from dairies and the direct conversion by computation to equivalent whole milk loss may actually give a figure in excess of the true loss of income to the creamery. [2] This is true because some of the waste products have little monetary value, and yet must be treated.

Besides controlling losses and revising processes, which everyone has heard much about, the residual waste must be treated to the satisfaction of both the manufacturer and public authority. One of the first available attempts to treat creamery wastes dates back to 1887. [3] Since that time, all of the present day processes used to treat domestic sewage have been used, with varying degrees of success, to treat dairy wastes. Most

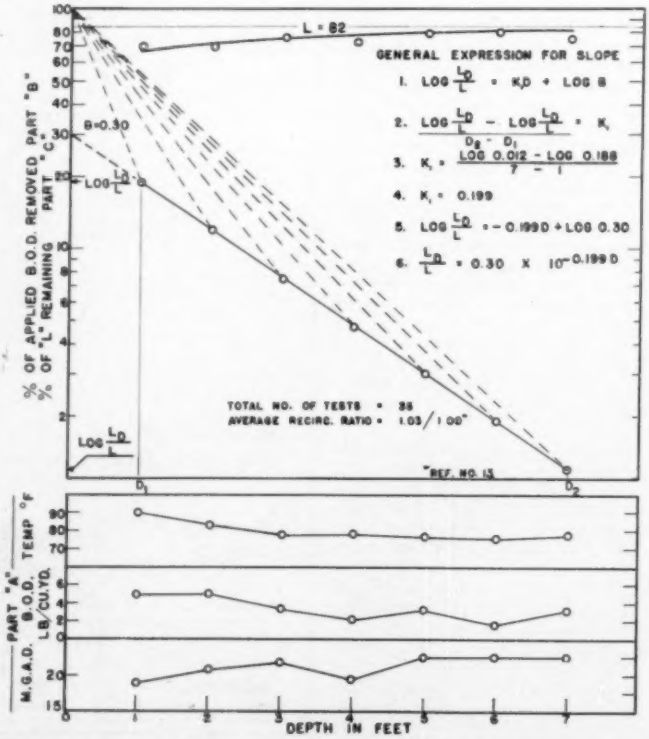

L = 82
GENERAL EXPRESSION FOR SLOPE
B=0.30
TOTAL NO. OF TESTS = 35
AVERAGE RECIRC. RATIO = 1.03/1.00
"REF. NO. 13
% OF APPLIED B.O.D. REMOVED PART "B" % OF "L" REMAINING PART "C"
PART "A" B.O.D. LB./CU.YD. TEMP. °F
M.G.A.D.
DEPTH IN FEET

Fig. 3—Performance of High-Capacity Trickling Filters—Recirculation Ratio—1.03:1.00

written about at length. Most of the published data, however, have been obtained from widely separated plants operating under many varying conditions. For this study, in cooperation with the Prewitt Creamery, Austin, Tex., a pilot plant of the trickling filter type was erected. The plant was operated at varying depths, with different recirculation ratios, semi-controlled B.O.D. loads, and at a constant temperature which supposedly is near the optimum for abundant bacterial growth.

The general consensus of investigators seems to be an acceptance of high capacity filtration as a proven process, but the distinct method or means proposed to attain this high capacity is still the subject of much controversy. It is believed that some of the variable factors in plant design can be taken out of the picture when the waste is applied at a continuous uniform rate over the media and when only one recirculation scheme is adopted as standard. Thus it is important to know the rate of organic extraction which can be expected for various depths while the recirculation ratio is varied at each particular depth.

A complete schematic drawing of the pilot plant used in these studies is shown in the Flow Diagram (Fig. 1). A galvanized, 20-gage, sheet metal filter shell was constructed so as to have a diameter of eighteen inches, and was fitted together in segments in order that successive one foot depths could be added to or taken off the top as desired. The distributing mechanism applying the waste to the media consisted of a four arm rotary distributor with holes bored on one and one-half inch centers. This mechanism rotated at about 50 revolutions per minute, and was found to distribute the waste uniformly.

The aggregate used in the filter was stream-worn stone having round and angular edges. The size of the stone varied fairly uniformly between two inches and three and one-half inches in diameter.

The pumps were a combination of small electrically driven centrifugal, laboratory pumps; diaphragm hypochlorinator pump; and converted automobile fuel pumps [9].

Pasteurized skimmed milk with a B.O.D. of about 73,000 p.p.m. was used. Milk waste was chosen in preference to domestic sewage because the experiment could be controlled with a greater accuracy. It was found that the milk had to be boiled in addition to pasteurization if the waste, being applied to the filter, was to be in a relatively fresh

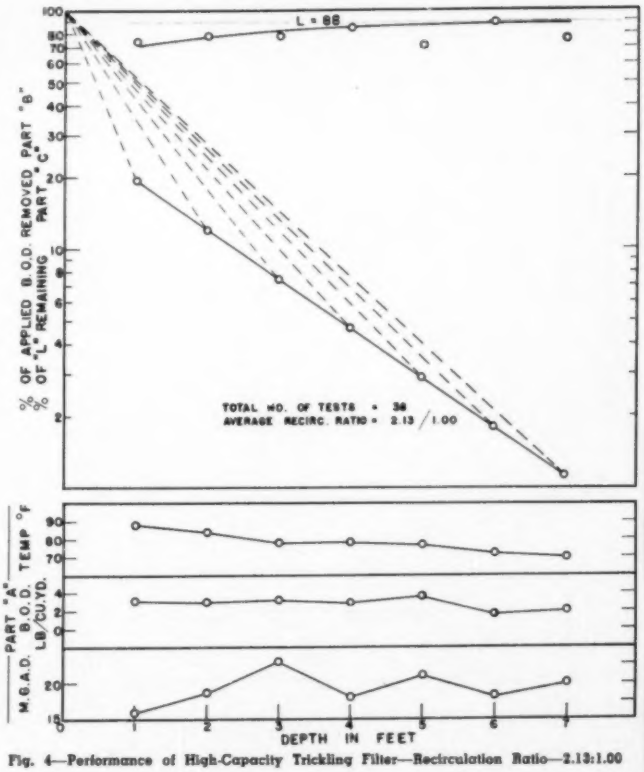

L = 88
% OF APPLIED B.O.D. REMOVED PART "B"
% OF "L" REMAINING PART "C"
TOTAL NO. OF TESTS = 38
AVERAGE RECIRC. RATIO = 2.13 / 1.00
PART "A" B.O.D. LB./CU.YD.
TEMP °F
M.G.A.D.
DEPTH IN FEET

Fig. 4—Performance of High-Capacity Trickling Filter—Recirculation Ratio—2.13:1.00

state. The advantages in having a non-septic waste were that the rate of flow, B.O.D. and pH could be more closely controlled. As indicated in part "A" of Fig. 2-7, the organic and hydraulic loads were controlled rather closely.

Problems

This discussion would not be complete without telling the reader about some of the plant operational problems. Psychoda flies were effectively controlled with a commercial DDT spray. Another interesting development was the appearance of Dero worms. The Dero *limasa ledy* worms are earth worms belonging to the group of Oligochaeta and the family of Naidum. [10] These worms live chiefly in tubes of their own making or with their bodies buried in a decaying organic mass. The worms are really not of the type which thrive in fresh water, but rather a species which grow under septic conditions. The worms became apparent whenever septic conditions prevailed and as can be expected, where fermentation exists the Dero worms feed extensively on the zoogloeic masses. The worms multiplied rapidly enough to completely coat the walls of the containers in 24 hours.

Tap water containing about 0.7 ppm. chlorine residual in the form of chloramines destroyed the worms in the pans while non-septic waste reconditioned the filter again. The worms gained entrance into the filter through the few gallons of "seed" sewage which was added to the waste in order to keep the filter bed well supplied with organisms.

Theoretical Basis of Study

The general recognition and adoption of the oxygen demand (B.O.D.) yardstick in the measurement of organic pollution serves to measure the efficiency of a waste treatment plant. This B.O.D. expresses the *rate* of biochemical reaction in which time appears as a function.

Butterfield and Wattie [9] described certain zoogleal bacteria in filters as being very similar to the organisms found in activated sludge. These bacteria form the heavy growth on the stones, and within this jelly these organisms, which are highly specialized, are associated with other bacteria. There will, of course, also

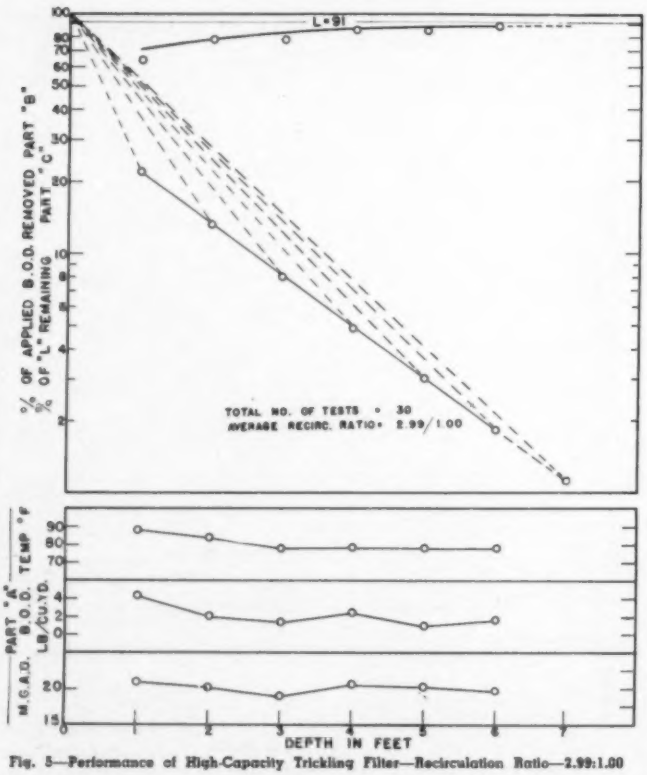


Fig. 5—Performance of High-Capacity Trickling Filter—Recirculation Ratio—2.99:1.00

be a diversified fauna, chiefly species of protozoa and of the lower worms. This living mass has the property of absorbing organic matter from solution, of coagulating colloidal matter, and of flocculating or "gathering" finely divided suspended matter. These substances then are either permanently removed from the fluid or the particles are effectively delayed from passing through the bacterial mass.

A study of the mechanism of a high capacity trickling filter shows that it is a removal or separation of impurities; but such a process of biophysical separation will certainly not continue in the absence of biological activity. It is also recognized that a considerable time element is introduced for the work of oxidation, and this element of *time* is quite independent of the time of passage of the fluid.

"The rate of extraction of organic matter per interval of depth of a biological bed is proportional to the remaining concentration of organic matter, measured in terms of its removability." [12]

This theory proposed by Velz is general and is similar to the well-known biological oxidation law used by Phelps. Several things, such as the colloider action, change in synthetic-oxidative relationships at various temperatures, and the influence of nitrification upon the rate of extraction "k" [13] are still not tied down very closely. The basic expression as presented by Velz may be derived as presented in Fig. 2.

The total amount of B.O.D. which can be removed, expressed in per cent, is the removable fraction "L" and is dependent on several variables. Since "L" is dependent upon these variables, as many variables as possible must be held constant or nearly constant as each independent condition is studied. These variables are temperature; hydraulic loading; organic loading; condition or state of solids, dissolved or colloidal; fresh or septic; pH; and operational control.

Since these variables are so closely related, all factors should be kept in mind as each variable is studied. It is obvious that temperature cannot be neglected for the rate of reproduction of flora and fauna is a direct function of temperature. Levine and associates [13], along with Velz in his expression of "L", point out that the rate of application in mgad. will play an important role in the overall removal of B.O.D. The N.R.C. Report, however, showed that organic loading has a greater influence upon efficiency than does the hydraulic rate of dosing. [12]

While organic loading and hydraulic loading may be closely related and whereas high loadings and high recirculated flows should produce very active biological matrices, high hydraulic rates of dosage per unit of area will increase the washing action so that loose growth will be continuously washed into the effluent stream. The effective organic loading is itself dependent upon many variables but reaches a limit even under the most ideal conditions. According to Walton [16] and associates, the maximum removal of 0.7 lb. per sq. ft. per day is indicated for all loadings in excess of 1.2 lb. per sq. ft. per day.

The condition or state of a waste to be treated is an individual problem and is usually never repeated. The pH on the other land, may be the most important problem to be studied. The writer has made tests on a high capacity filter, and when the pH was allowed to drop to 4.8, the efficiency of a seven foot filter was about the same as that of a three foot filter using a waste with a pH of 6.8. This apparent expected reduction in overall per cent removal is not at all surprising since Max Levine [9] states that a large portion of the bacteria cease to function at a pH less than 5.0.

Heukelikian [9] made an extensive study and comparison between high capacity and standard capacity filters and found that the chemical, biochemical, and biological characteristics of film at different levels in both types of filter are different quantitatively. The difference in the two types of filters lies in the relative magnitude of oxidation carried on within each filter. Both types of filters remove materials from waste by absorption and "colloider" action. The relative amount of absorption increases as compared to oxidation when the load increases.

Application Of Observed Data

The results of 301* days of data are plotted in Fig. 2-7 inclusive. Part "A" of each figure is a plot of mgad., lb. of B.O.D. per Cu. Yd., and temperature in degrees F.

*Sixty points were obtained from K. R. Jones' M. S. Thesis, "An Experimental Investigation of The Ability of Shallow Standard Trickling Filters to Remove B.O.D." The conditions for all points are equal.

plotted against depths of individual filters. Part "B" of each figure (the ascending curve) shows the per cent of applied B.O.D. removed, plotted against depth. This applied load in this case is the organic load in the untreated waste, exclusive of any organic load in the recirculated liquid. Part "C" of each figure (the descending curve) is the per cent of "L" remaining for each point in Part "B" plotted against depth. The points for Part "C" are more expressly found by $\frac{L_D}{L} \times 100$, where "L_D" is the difference between "L" and a point on the per cent removal curve.

"L" is a value which is obtained by extending the per cent removal curve until it becomes asymptotic to some value. It appears that, if lines are drawn through the points obtained in different recirculation ratios, the per cent removal curves do not become asymptotic to the maximum "L" until the lines are extended beyond the points for which data were obtained. This immediately may give some grounds for doubtful values. For all practical purposes in this paper, however, the values of "L" obtained seem to work quite nicely. The values of "L" would certainly change a little for different plants and when different variables are introduced. In studying the results expressed in Fig. 2 to 7 inclusive, it seems to indicate that the value of "L" is increased considerably by recirculation. This recirculation was changed without changing the hydraulic rate of application. From general knowledge, the removable fraction "L" can be expected to decrease as the rate of application in mgad. increases. In an ordinary sewage treatment plant, the higher the recirculation ratio the higher will be the hydraulic rate of application. One of the ways in which the hydraulic rate can be controlled with varying recirculation ratios is to have larger bed areas. It was the purpose of this study to find out the effectiveness of each recirculation value, and in pilot plant studies it was easy enough to control the plant influent rate.

Assuming that values of "L" are correct for this paper, the next important item of interest is the rate of extraction "k". The "k" value is graphically shown in Part "C" as the slope of a line. If we draw a line from the 100 per cent B.O.D. remaining in the waste to the per cent of "L" remaining (Part C) and make it for any depth, we should

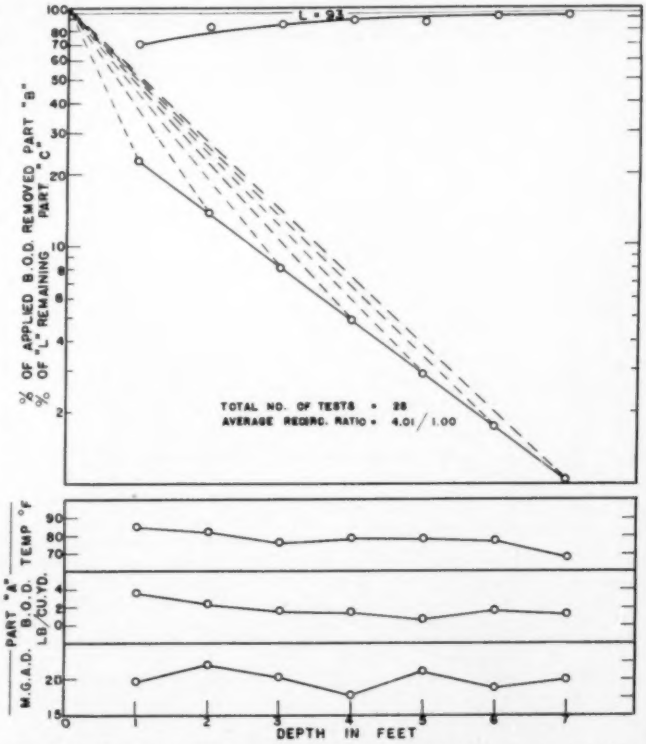

L = 93
% OF APPLIED B.O.D. REMOVED PART "B"
% OF "L" REMAINING PART "C"
TOTAL NO. OF TESTS = 28
AVERAGE RECIRC. RATIO = 4.01 / 1.00
M.G.A.D. PART "A" B.O.D. LB./CU.YD.
TEMP °F
DEPTH IN FEET

Fig. 6—Performance of High-Capacity Trickling Filter—Recirculation Ratio—4.01:1.00

have the average rate of removal which took place in a filter. This average rate of course is not going to be the same for filters of different depths since the rate of removal is never the same for successive depths within a filter.

The average rate of extraction "k", in a filter of a given depth, is primarily governed by the depth of media which is available as a foundation for the growth of biological mass. By comparing Fig. 2 Part "C" with Part "C" of Fig. 3 to 7 inclusive, it is obvious that the average rate of extraction is less at a standard rate of flow than at a high capacity rate of flow. It also becomes apparent that the average rate of extraction for any depth of filter is little affected by different recirculation ratios. In Fig. 3 to 7, Part "C," the average rates of extraction are approximately the same at the seven foot depths and vary only a little more at the one foot depths. This slight variation may be due to a slight error in obtaining the correct value of "L." It should be pointed out that if different values of "L" are used the lines connecting different depths in Part "C" seem to have a common intersection point which is at zero depth.

One might wonder why the per cent removal curves in Fig. 3 to 7, Part "B," are about the same at the one foot depths for any value of recirculation, while the per cent removal varies somewhat more at the deeper depths. This is probably due to a general increase in temperature and slight increase in organic loading, or it may also be another clue as to why the "k" values are not exactly the same for all values of recirculation.

Conclusions

A prepared milk waste was treated with a small eighteen inch diameter trickling filter. The depth was varied from 7 feet to 1 foot for hydraulic loadings of about 20 mgad. and 3 mgad. Data were also obtained at the one-half foot depth for low hydraulic rates. Temperature and organic loading was controlled throughout the experiment, but more closely controlled at the deeper depths.

This paper, which is based in part upon Professor Velz' "Basic Law for Biological Beds," does not propose

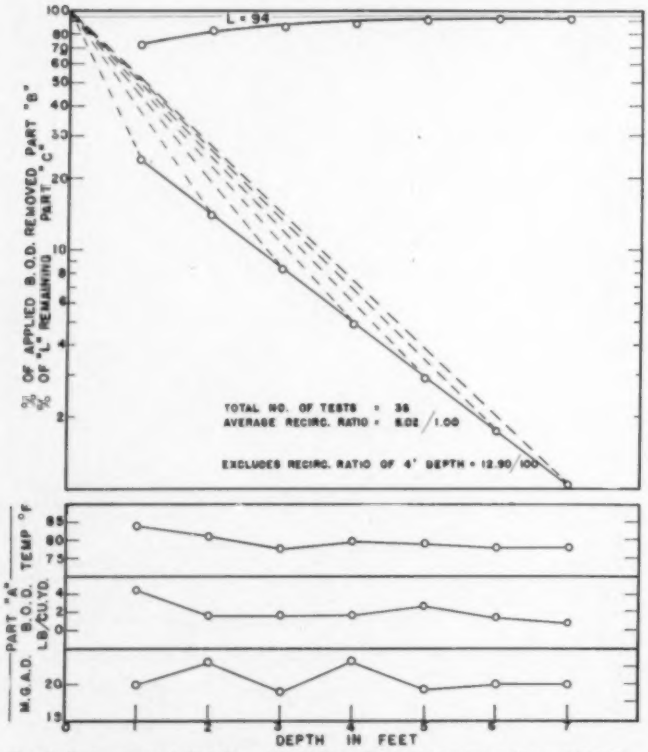

L = 94
% OF APPLIED B.O.D. REMOVED PART "B"
% OF "L" REMAINING PART "C"
TOTAL NO. OF TESTS = 35
AVERAGE RECIRC. RATIO = 5.02 / 1.00
EXCLUDES RECIRC. RATIO OF 4' DEPTH = 12.90 / 100
M.G.A.D. B.O.D. TEMP °F
PART "A" LB/CU.YD.
DEPTH IN FEET

Fig. 7—Performance of High-Capacity Trickling Filter—Recirculation Ratio—6.02:1.00

to present absolute principles. Inasmuch as the application and effectiveness of the various precepts discussed in this paper are still only loosely tied down, further interest and investigation would appear to be in order. The conclusions, however, which seem to be justified by this study are as follows:

1. The rate of extraction for all filter depths increases with an increase in hydraulic loading.
2. The average rate of extraction for all filter depths is about the same when the hydraulic loading is kept approximately the same and different recirculation ratios are employed.

References

1. Barritt, N. W., "The Purification of Dairy Waste Waters." Sewage Purification, *1*, 118 (March, 1939).
2. Bloodgood, Don E., "Milk Waste Disposal." Sewage Works Journal, *20*, 4, 695 (July, 1938).
3. Ibid, 698.
4. Butterfield, C., and Wattie, E., "Studies of Sewage Purification XV, Effective Bacteria in Purification by Trickling Filters." Sewage Works Journal, *13*, 639 (July, 1941).
5. Cosens, K. W., and Gloyna, E. F., "Laboratory Size Pump Developed." Industrial Hygiene Newsletter, *9*, 3, 13 (March, 1949).
6. Davy, Phillip S., and Noth, Melvin J., "Milk Losses and Milk Waste Disposal." Public Works Magazine, 23 (July, 1947).
7. Eldridge, E. F., "Dairy Waste Disposal." Sewage Works Journal, *21*, 4, 668 (July, 1949).
8. Heukelekian, H., "Similarities and Differences Between Biofilter and Standard Filter." Sewage Works Journal, *20*, 5, 1039 (November, 1948).
9. Levine, Max, "Destruction of Carbohydrates and Organic Acids by Bacteria Form A Trickling Filter." Bulletin 110, Iowa Engineering Experiment Station, *30*, 50, 48 (May, 1932).
10. Levine, M., Luebbers, R., Galligan, W. E., and Vaughn, R., "Observations on Ceramic Filter Media and High Rates of Filtration." Sewage Works Journal, *8*, 4, 701 (September, 1936).
11. Mueller, Alexander, "Die Desinfection der Molkerei." Milch Zeitung, *16*, 119 (1887).
12. National Research Council, "Sewage Treatment at Military Installations." Sewage Works Journal, *18*, 5, 964 (September, 1946).
13. Ibid, 969.
14. Research Committee, "A Critical Review of The Literature of 1948 on Sewage and Waste Treatment and Stream Pollution." Sewage Works Journal, *21*, 2, 234 (March, 1949).
15. Velz, C. J., "A Basic Law for the Performance of Bioilogical Filters." Sewage Works Journal, *20*, 4, 607 (July, 1948).
16. Walton, G. W., and Warrick, L. F., and Wilson, J., "High Daily Rate Trickling Filter Performance." Sewage Works Journal, *16*, 1, 203 (January, 1944).
17. Ward, H. B., and Whipple, G. C., *Fresh Water Biology*, p. 640, New York, John Wiley and Sons (1918).

Milwaukee's New Centrifugal Pump

During the past summer, the City of Milwaukee, Wis. officially accepted a new 60 mgd. Allis-Chalmers Pump at the Riverside Station.

Shown in the accompanying photograph is the new pump being inspected by H. P. Binder, Mgr. of Allis-Chalmers centrifugal pump dept., Edw. F. Tanghe, Supt. of the Milwaukee Water Works, and H. B. Hoefer, Chief Engr. of the Milwaukee pumping plants.

The new pump is driven by a steam turbine through Falk reduction gears. Despite its capacity it occupies only the same space formerly occupied by a 20 mgd. pump installed 25 years ago. This new unit gives the Riverside Station two 60 mgd. pumps.

An Index of Nomograms

The Technology Press, MIT, and John Wiley & Sons, Inc., New York, N.Y., have jointly published a book titled "An Index of Nomograms" by Douglas P. Adams. This unusual index lists over 1,700 published nomograms in well-known periodicals, and directs the reader to the nomogram he will need for the quick and accurate solution of his problem.

The book is divided into two main parts, Index A—Key Words, and Index B—Master Index. In the first, the reader will find an alphabetical list of key words which are associated with each of the diagrams. Following each entry is the key number permitting reference to Index B where the periodical, date of issue, volume, number, and page number of the nomograms are listed. A section of the book is devoted specifically to the Water & Sewage Works field. It may be obtained from John Wiley & Sons, Inc., New York, N.Y. for $4.00 per copy.

Water Starts Fire!

A U.P. release from Vincennes, Ind., carried this startling headline, which was explained as follows:

"Water started a fire in the home of Clarence Fisher—believe-it-or-not. Water splashed on a fuse box and caused a short-circuit which started the fire."

ECONOMICS OF WASTE TREATMENT*

With Particular Reference to Acid, Plating, Paper, and Oil Wastes

by

V. J. CALISE
Technical Director
GRAVER WATER CONDITIONING CO.
NEW YORK CITY

WATER is the major raw material employed by most industries and utilities. Consequently two important problems are presented in manufacturing and utility operations: (1) Obtaining a low cost, abundant supply of water which is satisfactory for various plant requirements, and (2) Disposing of contaminated or polluted waste waters after use.

In some plants, proper treatment of waste waters can help solve the problem of insufficient or high cost raw water by providing a supply of clarified waste water of proper chemical composition. This is of special value where normal surface water supplies are insufficient during most of the year or where they are highly polluted and costly to purify, and also where the underground water table is low and water is costly to obtain in adequate quantities.

Restrictions on Waste Disposal

Many states have adopted regulations prohibiting the introduction of various wastes into rivers and streams. Included in the regulations are prohibitions against the discharge of acids and alkalies; toxic metallic cations such as Cr^{+++}, Zn^{++}, Pb^{++}, etc.; suspended solids, oils and other wastes. The federal water pollution control bill, Pub. Law 845 also is designed to abate industrial as well as domestic waste pollution of streams. These regulations and restrictions designed to abate stream pollution make it imperative that industrial wastes be treated before discharge.

Among those wastes which must receive treatment are those from plating processes, pulp and paper mill, and oil refinery. It is the purpose of this paper to discuss some economic factors entering into the selection and operation of waste treatment facilities in these industries.

Factors in Design and Cost of Equipment

While many waste problems require laboratory and pilot plant investigation, there are a number of problems and applications where the pattern of waste water composition, chemical treatment and equipment design is well established on the basis of experience and operating data with existing installations.

The Author

The selection of the proper process and equipment for treating any waste water is mainly a problem in economics. It is the job of the equipment engineer to select the process and chemical dosages and to design the equipment which will yield the required purity of treated waste water at lowest cost and with greatest convenience in fitting into the existing plant flow sheet.

Aside from the requirements of foolproof design and proper performance results, it is usually important to reduce the long term operating cost of waste water treatment plants to the very lowest values. Factors which enter into the long term operating costs include:

a. Cost of chemicals.
b. Initial investment equipment.
c. Maintenance.
d. Cost of labor.
e. Possibility of recovering valuable products or reusable water from waste water.

ACID AND PLATING WASTES

The small or intermediate size plating plant, employing electroplating processes for copper, cadmium and chromium plating, is frequently faced with the problem of disposing of small volumes of wastes in existing sewer lines. In most cases, the flow of acid plating wastes is continuous during plating operations and the amount of acid and metallic impurities is fairly constant.

Simple Alkali-Chlorine Treatment

For such requirements, a simple alkali and chlorine (if necessary) feeding system is shown in Fig. 1. This is a constant rate system with push button semi-automatic operation. When the plating line is in operation a constant stream of acid waste con-

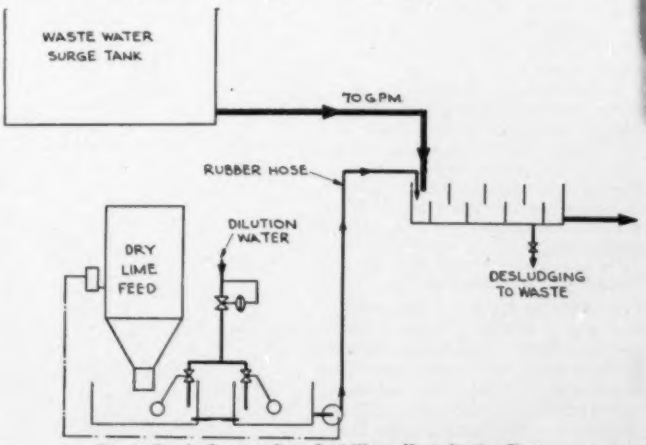


Fig. 1—Simple Constant Rate Acid Waste Neutralisation Plant

*A paper presented before the Amer. Inst. of Chem. Engrs. and here published in condensed form by permission.

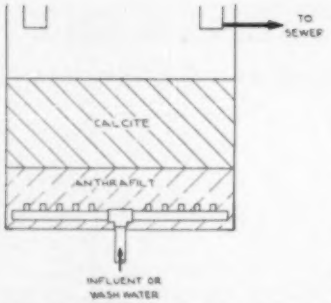


Fig. 2—Simple Upflow Calcite Filter for Small Volume Acid Waste Neutralization

taining small quantities of metallic cationic impurities flows to a short detention, baffled mixing chamber into which lime and hypochlorite are fed in preset quantities.

Lime is fed by means of a simple dry feed, diluted with plant water in a pump suction box and pumped with a centrifugal pump through easily-cleaned rubber hose into the baffled mixing tank. Hypochlorite is fed for oxidation of traces of cyanide and other organic impurities. (Chlorinators are used where larger quantities of chlorine are required.) This equipment usually costs $1500 to $2500 installed depending on size of feeders, quantities of impurities and other factors and is easily installed and convenient to operate. In some locations caustic soda is inexpensive and easily available and is employed in place of lime.

Fig. 2 shows a simple upflow calcite filter unit which can be employed to neutralize small concentrations of pre-settled acid wastes in certain cases. Calcite ($CaCO_3$) is a low cost chemical (average cost 2c per lb.) and can be easily replaced in the open top upflow filter unit. Upflow rates as high as 3 gpm. per sq. ft. can be employed for certain applications. Chlorination of the waste water can also be used where necessary. The filter shell is usually lined with a corrosion resistant material and corrosion resistant alloys are used for piping and fitting construction. A simple, open top upflow lined steel shell filter unit of design shown in Fig. 2 would cost $750 to $1400 depending upon flow rate of 50 to 150 gpm.

Controlled Neutralization

In some plants, large volumes of acid waste waters of varying acid content require neutralization before discharge into settling basins and open streams. In such cases it is necessary to vary the lime dosage accurately in proportion to acid content, and also, it is important to employ minimum doses of lime in order to maintain lowest operating cost.

Fig. 3 shows a typical arrangement employed for such applications. With this system the acid wastes are pumped at a constant rate into the baffled mixing trough and lime is fed through a pH meter-controlled orifice valve which proportions lime in relation to pH of the mixture. Where necessary, chlorine can be fed from a chlorinator in order to reduce operating cost. With this system, stoichiometric quantities of lime are employed so that operating cost for lime is 0.08c per 1000 gal. per. gr. per gal. of acid in the water assuming 0.7c per lb. cost for hydrated lime. Equipment shown in Fig. 3 for treating 250 gpm. of acid waste water containing an average of 20 gr. per gal. of free mineral acids would cost $2500 to $5000 depending on concentration of acids and total volume of waste water.

In some cases, plants having acid wastes have been able to utilize alkaline wastes from adjacent plants as an inexpensive neutralizing agent. In such cases a simple arrangement involves presettling and retention, followed by metered and controlled pumping of acid and alkaline wastes in proportions designed to effect the desired neutralization before discharge into open streams.

In other cases, high concentrations of objectionable impurities such as oil, chromium, zinc and cyanide salts are present in waste waters and must be reduced to satisfactory low concentrations by proper treatment. In such cases, an arrangement as shown in Fig. 4 is employed, utilizing primary and secondary clarifying units. The secondary clarifying unit can be a Solids-Contact Clarifier of the type shown in Fig. 5[6]. A coagulant such as ferrous sulfate, lime or soda ash and a coagulant aid such as activated silica is used for this purpose.

Various methods have been suggested for recovering chromium, copper and zinc from brass mill wastes by means of ion exchange but, at the present time, practical means for recovery have not been completely successful.

Table I

STOCK CONCENTRATIONS IN WHITE WATER

Mill	White Water Discharged gpm.	Range of Solids Concent. lb. per 1000 gal.	Stock (Fiber & Filler) Lost lb./hr.	pH Range of White Water
A	400	3–4.5	90	5.5–6.5
B	1400	4–12	500	3.8–5.5
C	2000	2–4	360	5.5–7.0
D	1200	3–6	290	4–7

PULP AND PAPER MILL WHITE WATERS

The amount of stock comprising both fiber and filler which is discharged and lost in waste waters from pulp and paper mills is quite high. In Table I[8], are shown the concentrations of stock in white and waste waters from four mills. In some large paper mills, as high as 50 tons of stock, on a dry basis, are lost per day.

The reason for this loss lies in the inability of the Fourdrinier wire or any wire used in savealls or other machines, to effect a complete separation of suspended solids in water.

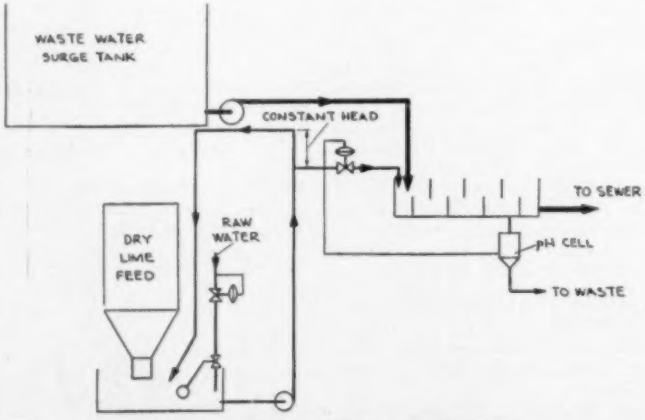


Fig. 3—Proportioning Acid Waste Neutralization Plant

Methods of Treatment

There are a number of devices for treating white and waste waters from paper mills. These "savealls" can be classified by the methods employed in separating fibers and fillers from the water as follows:

1. Screen filtration without pretreatment.
2. Settling in retention basins with or without chemical pretreatment.
3. Pretreatment with chemicals and pressure aeration followed by flocculation and skimming.
4. Coagulation with chemicals and clarification in a "Solids Contact" reclaimer.

With "savealls" listed under items 1 to 3 above, the separation of the fibrous solids is accomplished mechanically either by retaining the fiber on a fine mesh wire screen or by using large tanks so that the velocity of flow is so small that the fibers settle by gravity to the bottom, or with the aid of added reagents float to the top. With these devices, once the fiber or stock is separated, it is withdrawn from the scene of action and no longer plays any part in the treatment of the waste water.

Although the quality of effluent obtained with these "savealls" may be satisfactory for some reuse applications, it is not satisfactory for many cases, particularly, where the clarified waste water is employed in spray nozzles of Broughton showers. For many such applications, concentrations of stock of less than 0.25 lb. per 1000 gal. are required in the clarified waste water. Such low concentrations are easily obtained in a "Solids Contact" reclaimer. This unit is discussed in some detail below.

Solids Contact Reclaimer

"Solids Contact" reclaimers make use of a principle which has been employed successfully for many years in the chemical treatment of water supplies. The principle of operation is to provide prolonged contact of the incoming waste water and chemicals with a large concentration of previously accumulated suspended solids. Intimate contact with the suspended solids provides vast adsorptive surface areas to which the coagulated stock particles can adhere providing more effective and more complete coagulation while increasing the average size and weight of the stock particles which settle out more rapidly. Removal of more than 95 per cent of incoming waste water solids in a minimum of time and space is obtained.

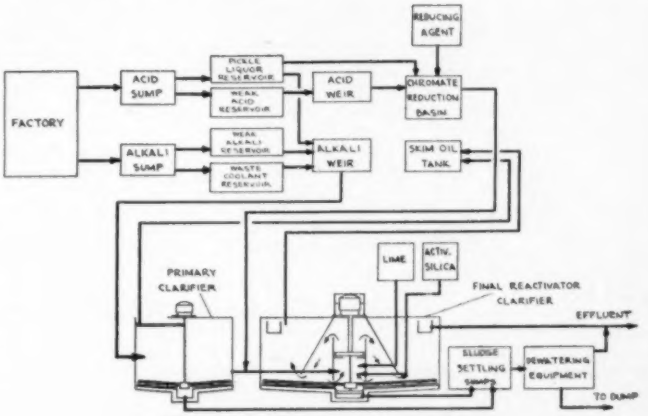


Fig. 4—Metal Plating Waste Treatment Plant

Fig. 6 shows a diagramatic sketch of a "Reactivator type Solids Contact reclaimer" and a flow sheet illustrating a typical plant installation. As shown, an agitator-pump, in the central uptake of the reclaimer, mixes water, chemicals and recirculated solids. Accumulated solids are recirculated by means of this agitator pump at two to six times the rate of flow of influent to and effluent from the Reactivator.

The mixture of water, chemicals and solids leaves the uptake and enters a conical flocculation zone where particles are permitted to coalesce and chemical reactions are further completed. At the bottom of the conical section the mixture is made to flow upwardly to the collector through a settling section of increasing upward area and therefore, continuously decreasing vertical velocity. The heavy, large particles settle out on the large bottom area of the Reactivator and are continuously moved towards a center sludge pit by means of slowly rotating sludge scraper blades. Lighter solids separate from the effluent water stream at the bottom of the conical section and are recirculated up through the central uptake by the agitator pump.

The main features of a solids contact reclaimer of this type are:

1. Intimate and prolonged contact of solids with the mixture of water and chemicals.
2. Positive and independent recirculation of previously formed solids.
3. Positive movement of settled solids to a concentrated sludge pit.
4. Large settling area (virtually the full bottom) of the Reactivator unit available for accumulating settled solids.

Coagulating chemicals, where necessary, are fed into the Reactivator by a proportionating pump or a wet type proportionating feed consisting of an inclined drawoff pipe, the top head of which is suspended by a chain wound around the feeding sprocket of the chemical feeding device. An inlet flow meter is usually employed to actuate the device through a contactor and timer arrangement. Feeding rates can be quickly and easily adjusted by remote control.

Although treatment chemicals are required in many cases, there are applications where sufficient alum and other coagulants and coagulant aids are present in the waste water itself in sufficient quantities to avoid re-

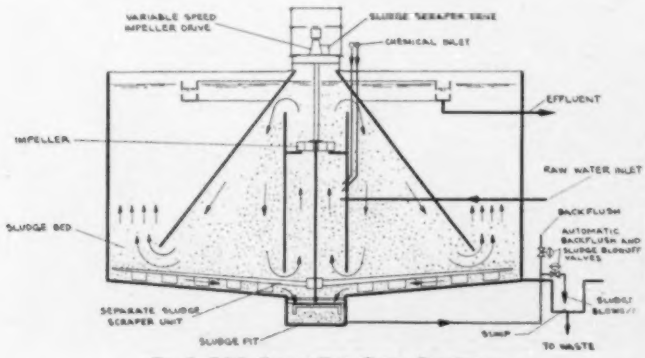


Fig. 5—Solids Contact Unit—Graver Reactivator

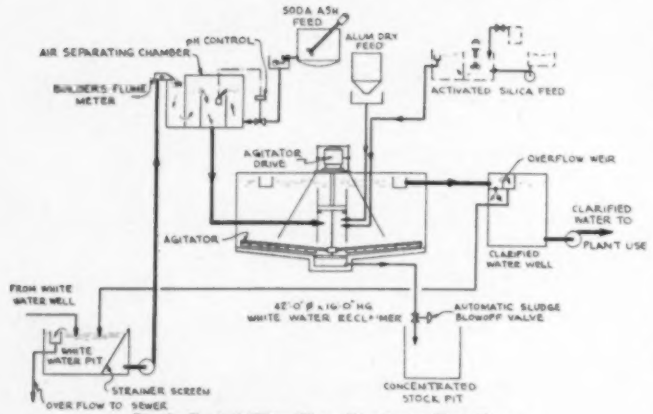


Fig. 6—Typical White Water Reactivator Flow Sheet

quiring additional chemicals. This somewhat simplifies plant operation and reduces operating cost slightly.

Economics of Treatment

As an example of overall cost for treatment of white water by solids contact reclaimers, a typical paper mill with the following conditions, may be considered.

White water to waste.....2.0 mgd. max.
Stock in white water.....2.5 lb./1000 gal.
White water temperature....summer—85°F
winter—70°F
Treated well water required....2.0 mgd. max.
Cost of well water.....2c/1000 gal.
Well water temperature.....55°F
Value of stock in white water.....$35/ton

Using the design installation shown in Fig. 6, calculations of the economics involved is as follows:

(a). *Recovered Stock:* With the treated effluent containing only 0.25 lb. per 1000 gal. of stock, the amount of stock recovered is 2.5-0.25 or 2.25 lb. per 1000 gal. or 4500 lb. per day.

(b). *Recovered Water:* With the recovered stock concentrated to 3 per cent in the sludge pit, then the volume of sludge (recovered stock) is 4500 ÷ 0.03 or 150,000 lb. or 20,000 gal. The recovered waste water, therefore, is 2,000,000—20,000 or 1,980,000 gpd.

Blowdown of treated white water discharged to waste in order to maintain total dissolved solids in recirculating water below 2500 ppm. = 25 per cent or 400,000 gpd. Therefore recovered clarifier white water available for reuse is 1,980,000—400,000 or 1,580,000 gpd.

(c). *Recovered Heat:* Heat recovered is calculated as follows:

$$\text{Btu. recovered per lb. of water} = \left(\frac{85-70}{2}\right) - 55 = 22.5$$

∴ Total Btu. recovered = (1,580,000) x 8.34 x 22.5 = 300,000,000 Btu. per day.

(d) *Equipment Cost:* One 1400 gpm. Reactivator (40 ft. dia. x 15 ft. high), complete with internal uptake, conical section controls, wet alkali proportioning feed, alum dry feed, activated silica feed, and air separation tank—$80,000 (incl. $35,000 for installation) to be amortized over a 10 year period.

(e) *Operating Costs:* Soda ash—0.3 lb. per 1000 gal. or 600 lb. per day at 1.6c per lb. = $10 per day or $3000 per year.

Alum—400 lb. per day at 0.87c per lb. = $3.50 per day or $1000 per yr.

Labor estimated at $8000 per year.

Total annual cost—Amortization—$8000, chemicals—$4000 and labor $8000 or $20,000 a year, total.

(f) *Savings per year:* Recovered stock—2.25 tons per day with 50 per cent used or 1.13 tons per day at $35 per ton = $39 per day or $11,700 per year.

Recovered water—1.58 mgd. at 2c per 1000 gal. = $32.00 a day or $9,600 a year.

Recovered heat—300,000,000 Btu. per day at average cost of $0.20 per mil. Btu. = $60 per day or $18,000 per year.

Total value of recovered products—Stock—$11,700; water—$9,600; heat—$18,000 a year or $39,300 total.

Savings of $39,300 less annual costs of $20,000 gives a net savings per year of $19,300.

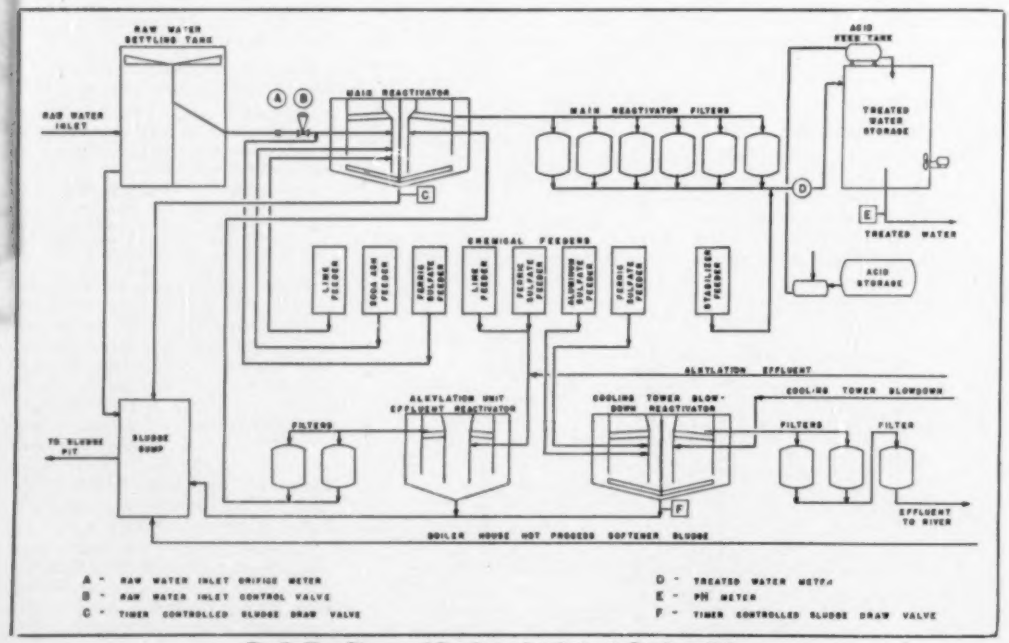


Fig. 7—Flow Diagram of Reactivator Installation in Petroleum Refinery

This calculation clearly indicates that the savings obtained under these plant conditions would permit payment of initial investment in about four years and thenceforth would permit savings of approximately $19,300 per year under stated price conditions. In addition, the problem of pollution of surface supplies is eliminated. Any concentrated stock not reused in the plant can be burned to avoid lagooning. Treated waste water can be discharged to waste without danger of pollution because it contains less than 0.25 lb. per 1000 gal. of stock.

A simplified solids contact reclaimer can be employed for smaller plants where nature of the solids is such that agitation, recirculation of solids and positive sludge scraper solids removal is not necessary. It is simple to install and operates easily at low cost.

OILY WASTE WATERS

In many regions of the country, waste waters containing oil and petroleum products have been a serious source of pollution of surface water supplies. In addition to pollution, in arid areas, obtaining a sufficient quantity of water for cooling and other petroleum refinery purposes is a serious problem.

The treatment and clarification of oil-containing waste waters, therefore, helps solve two problems: (1) Avoidance of stream or surface pollution, and (2) Obtaining sufficient water for plant purposes.

Fig. 7 shows a flow diagram of an existing Reactivator installation and other equipment in successful operation at a southwest refinery[3]. Originally approximately 1400 gpm. of oil containing waste water was discharged into a small stream. As a result of the installation and operation of Reactivator equipment, only 200 gpm. of clarified water is discharged to waste and 1200 gpm. are reused in the refining proper after treatment to soften and remove oil. Oil content is reduced from 250 to 20 ppm. Concentrated oily sludge obtained from the Reactivator is burned to avoid lagooning. The plant cost approximately $125,000 and chemical operating costs average 4.3c per 1000 gal.

Savings obtained by reusing clarified water average several dollars/day. In addition a continuous supply of water is assured without reliance on a stream subject to drouth and, of course, the problem of pollution of this stream by oily wastes is eliminated.

For some applications, it is required to remove much smaller quantities of oil. In such cases, preformed floc oil removal filters can be employed. Fig. 8 shows a photo of an existing 1000 gpm. preformed floc oil removal filter installation at a California public utility. Oil concentrations in costly condensate up to about 50 ppm. are treated with small quantities of alum in precipitated form as $Al(OH)_3$ and the mixture made to flow through anthrafilt oil removal filters containing rotary surface washers. These filters are first coated with a layer of $Al(OH)_3$ immediately after backwashing and a continuous feed of $Al(OH)_3$ with the oil assures a continuous absorptive layer for removing the oil.

The initial investment for such open air filter installations is not high, about $60,000 on installed basis and, of course, the chemical operating cost is quite low, usually less than 1c per 1000 gal. In addition, labor costs are very low because of minimum maintenance required with foolproof design. In case of the installation shown in Fig. 8, automatic filter backwashing and precoating and operation is obtained to minimize labor costs even further. It has been estimated that savings on recovered condensate at this point average more than $1 per thousand gallons.

References

1. "Treating Metalworking Wastes" — Engineering News Record, Vol. 141, No. 8, 91-5, 1948.
2. "Sludge Contact Reactors in White & Waste Water Treatment"—Paper Trade Journal, Aug. 12, 1948.
3. "Flocculation—A Method for Conditioning Refinery Effluent for Re-Use, Disposal"—Petroleum Processing, June, 1949.

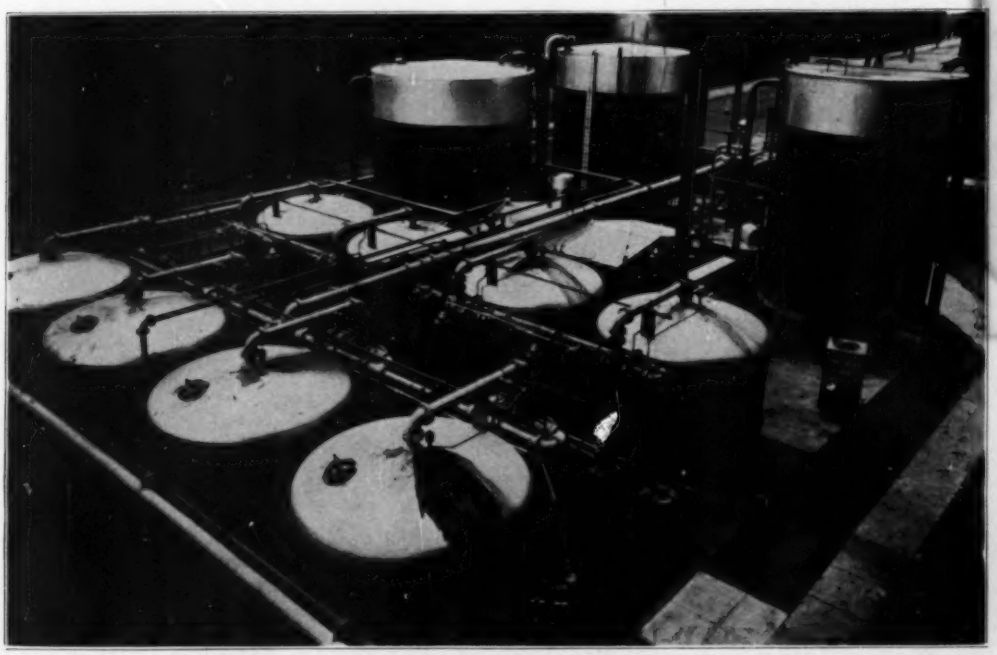


Fig. 8—Preformed Floc Oil Removal Filter—1000 gpm. Installed in California Public Utility

Comments of the Editors

Fluoridation Coming of Age

Those who may recall our earlier attitude toward fluoridation of public water supplies, and our advocacy of adopting this potentially promising means of reducing tooth decay suffered by our children, rather than adhere to the overly conservative policy of watchful waiting, with the resultant irretrievable loss of protection to certain age groups should the practice of fluoridation prove meritorious in time, will appreciate our decided interest in recent developments which denote a pointedly changing attitude toward fluoridation by scientific and policy making bodies.

Of marked interest is the fact that the *Journal of the American Medical Association* has now come out for water fluoridation as "a tremendous step forward in the fight against dental disease." In this official publication of the dental profession the following statements appear in the lead editorial of the August 1950 issue.

"Twelve years have elapsed since H. T. Dean of the U.S. Public Health Service presented his report on endemic fluorosis and dental caries. More than ten years have elapsed since the theory was first advanced that the addition of 1.0 to 1.5 ppm of fluorine to communal drinking water might reduce the incidence of dental decay.

Considerable courage was required of civic authorities to pioneer in these experiments since the field was entirely new, equipment and materials costly, and the toxicity of fluorine well known. As J. A. Bull states in his article, 'Control of Dental Caries by the Addition of Fluorides to Public Water Supplies,' published in this issue of THE JOURNAL, early consideration of the artificial fluoridation of communal drinking water divided dental caries researchers into two camps: those who accepted presumptive evidence as conclusive and recommended the immediate treatment of communal drinking water with 1.0 to 1.5 ppm of fluorine and those more conservative who advised waiting five, preferably ten years until the results obtained by a few carefully controlled fluoride studies could be evaluated. For the past five years, the controversy between the two camps has waxed warm. Recently data released by those in charge of the early studies seem to have brought the opinions of the two groups more closely together.

"In June 1949 the American Water Works Association after reviewing the results of several carefully conducted epidemiological studies on the relationships between fluoride occurring naturally in communal water supplies and the prevalence of dental caries, issued the following statement*:—

'In communities where a strong public demand has developed and the procedure has the full approval of the local medical and dental societies, the local and state health authorities, and others responsible for the communal health, water departments or companies may properly participate in a program of fluoridation of public water supplies.'

"On the 8th of June 1950 the State and Territorial Dental Health Directors, meeting in Washington, D. C., passed the following resolution:—

'Resolved, that the State and Territorial Dental Health Directors recommend the fluoridation of public water supplies for the partial control of dental caries, where the local dental and medical professions have approved this program and where the community can meet and maintain the standard required by the state health authority.'

"On the following day, June 9, Assistant Surgeon General Bruce D. Forsyth, of the United States Public Health Service, issued the following statement.

'Preliminary data indicate a lowered amount of dental decay following fluoridation of the public water supply.'

'In order to utilize this preventive at the earliest possible moment, therefore, fluoridation of public water supply as a procedure for the partial control of dental caries can be encouraged subject to the approval of the state and local health authorities and the dental and medical profession.'

"It appears certain from the data compiled from the few controlled fluoridation studies now under way that the addition of 1 ppm of fluoride to community drinking water inhibits dental decay. In fact, the reports warrant the assumption that the fluoridation of drinking water may, at the end of ten years, reduce significantly the incidence of caries.

"Certainly the opinions of such authoritative bodies as the American Water Works Association, the State and Territorial Dental Health Directors and the United States Public Health Service should dispel any lingering doubt about the advisability of fluoridating communal drinking water, and they should open the way of all communities having a central water system to provide a simple inexpensive measure which will partially protect their children from the ravages of caries.

"The artifical fluoridation of drinking water is not a cure-all. It will not protect children completely from dental decay, but it is a tremendous step forward in the profession's fight against dental disease and it should stimulate further investigation which will lead to a more complete solution of the caries problem."

In recent months two of our leading State Health Departments have revised their policies in respect to fluoridation of public water supplies.

The Michigan Dept. of Health, basing its change of policy upon the results from five years of fluoridation, at Grand Rapids and elsewhere, has issued the following statement as its *new policy*.

"From the evidence available to date the Michigan Department of Health is now in a positon *to recommend* the application of fluoride to public water supplies which are deficient in this element. Many water supplies in Michigan naturally contain some fluoride, but few contain it in sufficient amount to reduce dental decay."

"Before a public water supply is treated with fluoride it is necessary that the Michigan Department of Health be informed and approval of the local dental and medical professions is desirable."

The New York State Dept. of Health, basing its change in attitude upon observations during the controlled experimental studies of fluoridation at Newburgh, N.Y. since 1944, and results from similar studies elsewhere, has issued the following revised statement of policy which now gives *full approval* to water fluoridation under proper local supervision.

"If communities, after consultation with their local medical and dental societies, wish to establish this procedure, and where the communal water supply will lend itself to fluoridation and is under the direct supervision of a qualified engineer, the New York State Department of Health will make available its consultant staff in helping to plan the program and establish standards and procedures."

We believe that the time is at hand for all existing "hold-out" State Health Departments, which have been adhering to the now out-moded policy of "watchful waiting" during the period of controlled demonstrations at selected locations in the U.S. and Canada, to follow the pattern of revised policy which has been adopted by the New York and Michigan departments. And, based on overall experiences to date, we believe that there should no longer be any hesitancy on the part of water works managers to go forward whole-heartedly with fluoridation.

As a public relations matter we can think of no single immediate opportunity to place the water utility in a position of rendering appreciated additional service than that of reducing and checking tooth decay amongst the children of the community by so simple, controllable and relatively inexpensive procedure as is water fluoridation. Water supply men often decry the fact that there is so little opportunity to secure any "lime-light" in water supply service. We say again that we consider fluoridation of water the golden opportunity for water utilities to take the "lime-light," to the end that greater recognition comes to local water supply service—and, along therewith, rate increases where needed to defray the added cost of the new service.

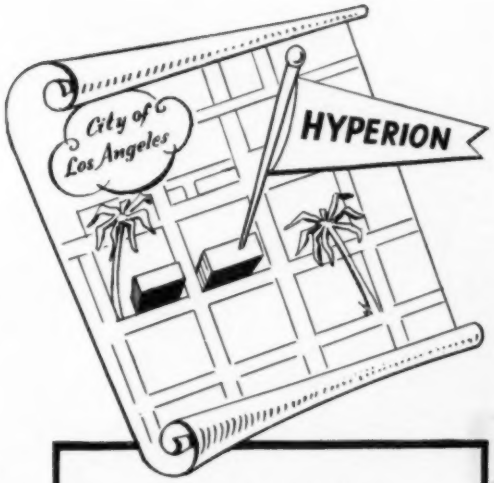
L. H. Enslow

*From the report of a special Committee on the Fluoridation of Public Water Supplies published in the Jour. Am. Water Works Assn.—July 1949.

Congratulations

TO THE CITY OF LOS ANGELES
ON THE OPENING OF THE

HYPERION PLANT



We salute the city which sponsored and the men who planned and built the Hyperion Activated Sludge Plant. One of the world's largest, it typifies progressive, modern Sewage Treatment design and construction. We are proud that CHICAGO Sewage Equipment is playing such an important part in its operation, as it is in thousands of other plants all over the world.

Congratulations

TO THE MEN WHO BUILT
HYPERION

THE BOARD OF PUBLIC WORKS,
CITY OF LOS ANGELES

- Lloyd Aldrich, *City Engineer*
- Merrill Butler, *Deputy Engineer*
- G. A. Parks, *Senior Engineer in Charge of Treatment Plant Design . . . Presently Chief Engineer, Plant Operation*
- F. M. Darnell, *Senior Engineer in Charge of Administration*

Metcalf & Eddy,
Frank L. Flood, *Consultant*

CHICAGO PUMP COMPANY

SEWAGE EQUIPMENT DIVISION

2300 WOLFRAM STREET — **CHICAGO 18, ILLINOIS**

Flush Elson, Scru-Peller, Plunger, Horizontal and Vertical Non-Clogs Water Seal Pumping Units, Samplers.

Swing Diffusers, Stationary Diffusers, Mechanical Aerators, Combination Aerator-Clarifiers, Comminutors.

SOME OF THE

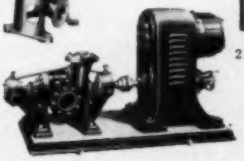
CHICAGO

Sewage Equipment
Supplied for HYPERION

850 Swing Diffusers and
19,531 Precision Diffusion Tubes

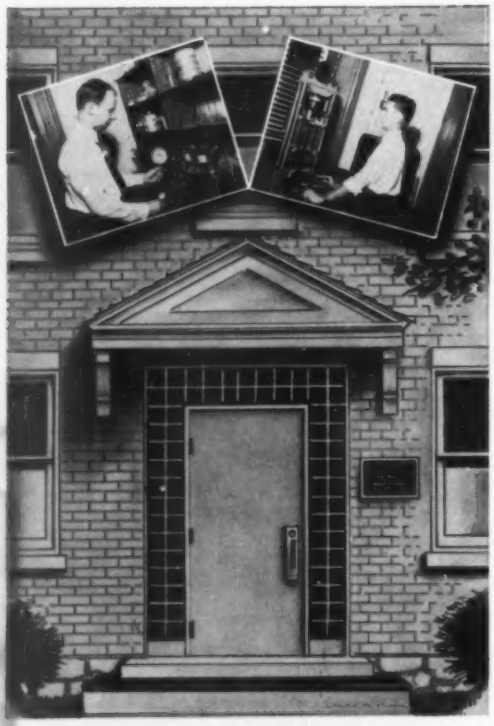
12 Non-Clog Pumps

2 36A Comminutors



27 Scru-Peller Sludge Pumps

22 Bilge Pumps and Miscellaneous Circulating Pumps



ATLAS RESEARCH
IS ON THE JOB - SERVING THE WATER WORKS INDUSTRY

Continuous research produces better products. The Maximallion F. Wirtz Memorial Research Laboratory, shown above, is dedicated to this axiom.

Here at Atlas we have a complete staff of competent Technologists who constantly test and improve our products . . . study your problems and offer solutions. Specify Atlas and take advantage of this "extra service."

Manufacturers of Hyde-Ro Rings; Tegul-Mineralead; G-K, hot-poured sewer joint compound and Atlastic 77, ready-mixed cold trowel type sewer joint compound. Special bulletins upon request, 23 Walnut Street, Mertztown, Penna.

THE ATLAS MINERAL PRODUCTS COMPANY
MERTZTOWN, PENNA. HOUSTON, TEXAS

MEETINGS SCHEDULED:

NOV. 1-3—WILMINGTON, DEL. (DuPont Hotel)
Chesapeake Section A.W.W.A. Sec'y, C. J. Lauter, 5902 Dalecarlia Place, Washington 16, D. C.

NOV. 6-7—RICHMOND, VA. (Jefferson Hotel)
Virginia Section, A.W.W.A. Sec'y, W. H. Shewbridge, 713 State Office Bldg., Richmond, Pa.

NOV. 13-15—DURHAM, N.C. (Washington Duke Hotel)
North Carolina Section A.W.W.A. and North Carolina Sewage Works Association. Sec'y, E. C. Hubbard, State Board of Health, Raleigh, N. C.

NOV. 12-15—FT. LAUDERDALE, FLA. (Governor's Club Hotel)
Florida Section A.W.W.A. Sec'y, Marvin R. Boyce, 504 Pennsylvania, Clearwater, Fla. (Joint Session with) **Cuban Section A.W.W.A.** Sec'y, L. H. Daniel, Baratillog 9, Havana, Cuba (and) **Florida Sewage Works Association.** Sec'y, Perry Teeple, P. O. Box 210, Jacksonville, Fla.

NOV. 16—BOSTON, MASS. (Hotel Statler)
New England Water Works Assn. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

NOV. 28-29—W. LAFAYETTE, IND. (Purdue Univ., Memorial Union)
1st Purdue Water Conservation Conference. Chairman, Don E. Bloodgood, Prof. San. Eng., Purdue Univ., W. Lafayette, Ind.

NOV. 30-DEC. 2—TUCSON, ARIZ. (Hotel Pioneer)
Arizona Section, A.W.W.A.
Arizona Sewage & Water Works Association. Sec'y, Helen Rotthaus, San. Eng. Div., State Capitol, Phoenix, Ariz.

DEC. 13—BREWER, ME.
Maine Water Utilities Association. Sec'y, Earle A. Tarr, Supt., Winthrop, Me.

DEC. 21—BOSTON, MASS. (Hotel Statler)
New England Water Works Assn. Sec'y, Jos. C. Knox, 204 Tremont Bldg., Boston, Mass.

JAN. 16, 1951—NEW YORK CITY, N.Y. (Park Sheraton Hotel)
New York Section A.W.W.A. (Mid-Winter Luncheon 12:00 Noon). Sec'y, Rollo K. Blanchard, 50 West 50th Street, New York, N. Y.

JAN. 19-20—NEW YORK CITY, N.Y. (Hotel Statler)
New York Sewage & Industrial Wastes Assn. Sec'y, R. C. Sweeney, 21 No. Broadway, White Plains, N. Y.

FEB. 15-16—ANN ARBOR, MICH. (Univ. of Michigan, School of Public Health)
Water Works Problems. The 3rd Inservice Training Course given in cooperation with the Michigan Section A.W.W.A. Dir., H. E. Miller, School of Public Health, Univ., of Michigan, Ann Arbor, Mich. (Enrollment Fee—$5.00)

FEB. 21-23—W. LAFAYETTE, IND. (Purdue Univ., Memorial Union)
6th Purdue Industrial Waste Conference. Chairman, Don. E. Bloodgood, Prof. San. Eng., Purdue Univ., W. Lafayette, Ind.

MAR. 13-16—NEW YORK CITY, N.Y. (Hotel Statler)
National Association of Corrosion Engineers. Exec.-Sec'y, A. B. Campbell, Southern Standard Bldg., Houston, Texas.

APRIL 5-6—ALBANY, N.Y. (Hotel Ten Eyck)
New York Section A.W.W.A. (Spring Meeting). Sec'y, Rollo K. Blanchard, 50 West 50th Street, New York 20, N. Y.

APR. 29-MAY 4—MIAMI, FLA. (Reservation Announcement Dec. 1st.)
American Water Works Association. (Annual Convention). Exec.-Sec'y, Harry E. Jordan, 500 Fifth Avenue, New York 19, N. Y.

Difficult Suburban Sewer Problem Solved with *CONCRETE PIPE*

THE ALEWIFE BROOK conduit project in the town of Arlington and the cities of Cambridge, Somerville and Medford, just north of Boston, posed an unusual construction problem that was solved with concrete pipe.

The installation of this difficult, trunk-line sewer required that pipe be placed in open-cut street crossings, in tunnels under streets, playgrounds and a railroad, along Alewife Brook which is generally well below the existing water table and finally under the bed of the Mystic River.

In crossing the river, the line was installed as an inverted siphon. This 230 ft. crossing was made by diverting the river to one side and installing two-thirds of the section then diverting the water back over that part of the line already installed.

The project required approximately 8300 ft. of 60-in. and 66-in. (ASTM specification C76, Table I and Table II) reinforced concrete pipe using in each case two rows of circular reinforcing steel.

This is but another example of the adaptability of concrete pipe. In addition, it has (1) structural strength to resist severe impact and to sustain heavy overburdens, (2) rugged durability proved by many decades of heavy-duty service, (3) tight joints and uniformly dense structure to insure minimum infiltration and leakage, (4) smooth interior surfaces which provide maximum hydraulic capacity and resistance to abrasion from suspended matter.

Concrete pipe is moderate in first cost, requires little or no maintenance and lasts much longer. The result: ***low-annual-cost*** sewer service.

AMERICAN CONCRETE PIPE ASSOCIATION

228 NORTH LA SALLE STREET, CHICAGO 1, ILLINOIS

. . . is corrosion eating away your profits?

SARAN RUBBER TANK LINING resists corrosion!

easily installed!

highly resistant to abrasion!

Saran rubber, developed by The Dow Chemical Company, leads the way to cutting corrosion costs to a minimum. The extremely high degree of chemical and abrasive resistance, found in saran rubber, makes it the outstanding tank lining where the storage and conveyance of grease, solvents, acids or other chemicals is indicated.

Saran rubber can be applied easily and economically by experienced tank lining applicators located strategically throughout the country. Saran rubber lined pipe is available also—8 inch diameters and larger, and up to 20 feet in length.

Get in touch with an applicator today by contacting your nearest Saran Lined Pipe Company office—find out how you can add many years to the life of your costly equipment. Write: Dept. TSP-101.

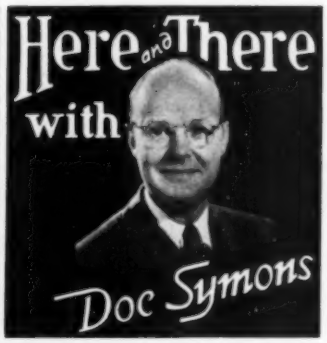
Distributed by

Saran Lined Pipe Company

2415 BURDETTE AVENUE • FERNDALE 20, MICHIGAN

Offices in: New York • Boston • Philadelphia • Pittsburgh Chicago • Tulsa • Indianapolis • Houston • San Francisco Los Angeles • Portland • Cleveland • Denver • Seattle Charleston, S. C. • Toronto

SARAN RUBBER a DOW product



Here's That Man Again — Very happy to be in the groove again, and although still on a diet of baked potatoes and steak (T-Bone for two preferred), I want to thank all those readers who were so solicitous when I got bedded down with my diverticulitis—One correspondent added a P.S. saying, "Take care of yourself and don't work too hard"—Nice to know that somebody cares—and did you ever notice that the best parts of some letters are often in the P.S.

* * *

Some of you may have read the report of the Canadian Section Meeting in April of this year. In it was a story of how Ross Dobbin laid a double pipe line across the river by floating it into place. Prior to the floating job, the pipe had been welded on the bank of the river. The newspapers and several amateur engineers had screamed that the pipe would sink. Ross insisted it would float but on the night before the "launching" he caulked up one length of pipe and tried it for buoyancy.—It floated—So did the pipe next day. The newspapers lauded Ross for sticking to his calculations —They didn't know he too was a little doubtful.

* * *

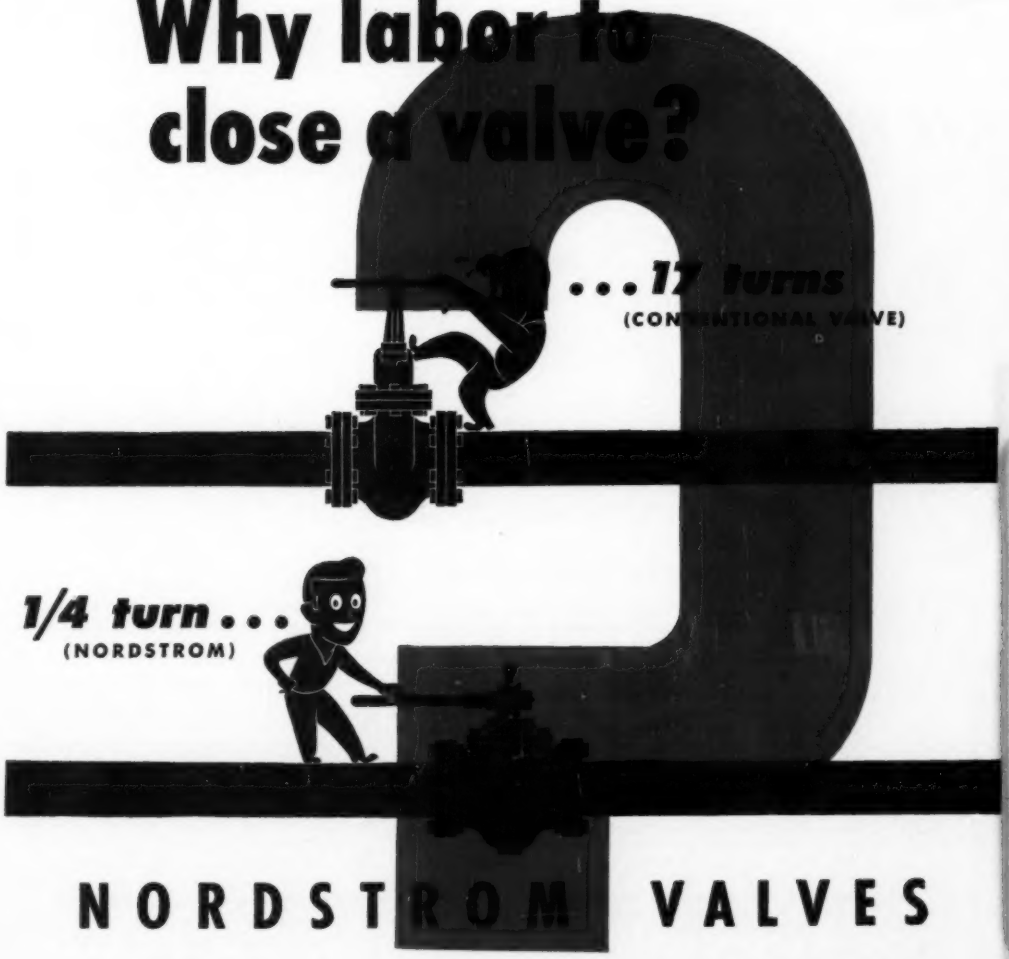
When Ed (Chicago Bridge and Iron) Alt, of Chicago was on the panel at the Illinois Section meeting he stated that there are *772* water supplies in Illinois and that 400 plus of these have elevated tanks. Which proved said Ed the importance of elevated tanks.—Couldn't be that there is a whale of a good tank salesman in Illinois. Could it, Ed?—Did you ever hear Dr. A. P. Black's story about the salt salesman.

* * *

WATER WORKS ROMANCE No. 12—One day during the war a young Navy Officer had taken his seat on the train to Washington. A short

(*Continued on page* 88A)

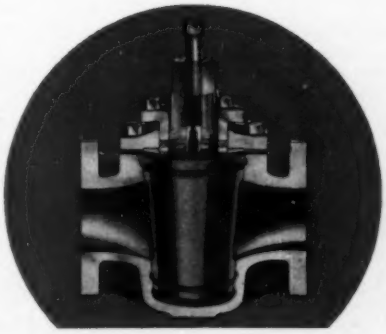
Why labor to close a valve?



NORDSTROM VALVES

Rotary Movement

It takes force to close a conventional valve because a wedging action must take place between the gate or disc and the seat in the body. *But no jamming force is needed to close a Nordstrom.* You merely turn the plug 90 degrees. The plug slides on a *lubricated* seat. There's no stress . . . no distortion . . . no stuffing-box problem.



Get Nordstrom Habit

Don't wait until an entire battery of valves needs replacement. Install a Nordstrom every time you have to replace a worn-out or troublesome valve. Progressive replacement with Nordstroms will soon upgrade your valve equipment standards.

ROCKWELL
MANUFACTURING CO.
400 North Lexington Avenue
Pittsburgh 8, Pennsylvania
Offices in All Principal Cities

FOSTER FLOW TUBE

Gentile Patents

FIVE FEATURES

for your Consideration:

1 . . . Compactness Note in the picture above the short axial length. Tubes 3" in size and larger are approximately 1 to 1½ diameters long, depending upon the velocity in the main. For high main line velocities (above 10 ft/sec. for liquids) tubes are less than 1 diameter in length.

2 . . . Ease of Installation Due to its compactness and because it requires no straight runs upstream or downstream, except near valves or regulators, the total space required for installation is but a small fraction of that necessary for other primary devices. It can be installed as readily as a fitting and in that section of the line most conducive to steady flow conditions. Moreover, it can be installed in the plant proper, eliminating the need for expensive vaults or housing.

3 . . . Reversibility The Foster Flow Tube is symmetrical transversely; upstream and downstream nozzles and ports are identical. This means that where processing calls for flow reversal, the meter can readily handle the changes.

4 . . . Low Head Loss Where head losses are important Foster Flow Tubes are designed with a main-to-throat ratio that provides negligible unrecovered head losses.

5 . . . Accuracy All Foster Flow Tubes are furnished with calibration curves obtained in laboratory tests simulating installation conditions and can therefore be guaranteed to an accuracy to meet any specification.

Foster Flow Tubes are recommended for a wide range of services metering the flow of liquids and wet or dry gases. They are available in all commercial pipe sizes with flanged or screwed connections. Standard lining is bronze but other materials are available. In writing for further information, give processing and installation details of your metering requirements.

FOSTER ENGINEERING *Company*

835 Lehigh Avenue • Union, N. J.

PRESSURE REGULATORS . . . RELIEF AND BACK PRESSURE VALVES . . . CUSHION CHECK VALVES . . . ALTITUDE VALVES . . . PAN ENGINE REGULATORS . . . PUMP GOVERNORS . . . TEMPERATURE REGULATORS . . . FLOAT AND LEVER BALANCED VALVES . . . NON-RETURN VALVES . . . VACUUM REGULATORS OR BREAKERS . . . STRAINERS . . . DIERS . . . SAFETY VALVES . . . FLOW TUBES

(*Continued from page 86A*)

time later a man and woman came aboard the train with a "very nifty dish"—obviously their daughter. The car was crowded, and the parents looked over the crop of possible seat mates for their daughter and turned to one Dave Wood, son of Alan A. (Builders-Providence) Wood of Philadelphia. Conversation went something like this, "Lieutenant, would you mind if our daughter sat with you, and will you see that she gets off at the right station. Her name is Rosalind."—You've guessed the rest of the story.—Dave married her when the war was over.

* * *

I surely was sorry not to get up to State College, Pa., for the annual meetings of the Pa.WWOA and Pa.S&IWA. Last year on the way back I stopped off at Bucknell University at Lewisburg, Pa. There on the campus I spotted a B.O.D. truck. Yes sir, on the side of the door of the truck was a large oval insignia in which were the letters—B.O.D.—Intrigued, I made a closer inspection and found that it was the advertising insignia of one B. O. Daubert, Master Plumber of Lewisburg.—No, I know, it's not funny but just one of those curious things that one runs into occasionally.

* * *

Seems as though all I have been doing this autumn is to say how sorry I was that I couldn't get to one convention or another.—That goes for the W. Va. S&IWA (and thanks for the note R.McB.) and the Canadian Sewage and Sanitation meeting in famed Bigwin Inn on Lake-of-Bays, Ontario.

I understand the latter really was a humdinger, with all kinds of contests and prizes etc., etc.—They tell me that one of the contests was between Beauty and the Beasts (The fair ladies against the men) and that the ladies walked off with the prizes; the men having to be content with miniature replicas of the statue of Venus. —All I could think of when I heard about this was the song which goes, "Venus de Milo was noted for her charms, but strictly between us, you're cuter than Venus, and what's more you've got arms!"—Hmmmm!

* * *

Did I ever tell you the story about Frank (Carborundum Porous Plate) Roe and Marge—and Peter—It was a few years back when hotel reservations were somewhat harder to get than they are now. Frank had wired ahead for accommodations, but had left, with his family, on the trip be-

(*Continued on page 89A*)

fore confirmation came through. It was late that night when they arrived at this hotel to find that their request for reservations had been denied. Of course, the hotel finally put them up for the night.—Now I have heard of people being put in sample rooms, in the ball room and elsewhere, but this is the first time I ever heard of a hotel putting its guests in the Ladies Powder Room. —Young Peter had a gay time with all the mirrors, and Frank said they had no visitors but he was awake a long time wondering.

* * *

Things I never knew until recently—Nicol Mac Nicol, Commissioner of Works, Forest Hill, Ont., Can., is one of the leading curlers of Canada.

* * *

Last fall, I was out in Indiana and stopped in at the Hays Mfg. Co. in Michigan City, Ind., and while waiting in the lobby, I copied this item from the bulletin board.—"God grant me the serenity to accept the things which I can not change, the courage to change the things I can, and the wisdom to know the difference."

* * *

Those of you who have read this column for a number of years, know that one of my favorite authors (or is it authoresses) is Nona Coxhead (Mrs. Paul Cerny, he of the Dorr Co.)—This is just to tell you that she has a new book out, with the title, "House of Mirror" and published by E. P. Dutton, New York City. Suggest that you get it!

* * *

While I didn't get to the Canadian Sewage Works Meeting at Bigwin Inn, I was in Toronto for a few days this autumn and saw a number of my friends including A. V. (Cap) and Sally DeLaporte, George and Fran Galimbert, and others, but I missed A. E. (Bert) Berry and the O. V. Balls (she's the one who writes such beautiful poetry, you know). "Bert" was in Saranac Inn, N.Y., at the N.Y. Sect. meeting in his capacity as AWWA Veep. The Balls were on their holidays at Haliburton,—and what's the newest story with you, Ollie?

* * *

It was in Toronto that Walter H. (Builders-Providence) Brown had the unusual experience of having a girl rush up to him on the street with the cry, "Highpockets" and buss him soundly, right in front of Eaton's Department Store. Walt spent the next hour and a half reminiscing with her about when they had gone to school together (he to Brown, she to Pembroke)—but when they said goodbye for another 17 years perhaps, Walt still didn't know her name.—It's a good story, "Highpockets."

* * *

One thing I learned recently—Gardenia petals are delicious to eat just before they begin to turn brown—but like olives it's an acquired taste. Just thought you'd like to know!

* * *

By now, you are well aware of the fact that the 20-Year Index to *Sewage Works Journal* is available at $4.50 per copy either from the Federation or The Gerrard Press, Champaign, Ill.

* * *

Up at the NEWWA Convention in Poland Spring, Me., I saw Ellis A. Tarlton, Cons. Engr., Danbury (the Hat City) Conn. It was Ellis, who wrote in my August column about Harry (Chlorine Institute) Faber's hat. I told Ellis I had recently received a communication from Harry on the subject and—here 'tis.

"Dear Doc—Footnote to a Footnote:
The hat situation, your treatment of:
Primary treatment; June column
Secondary Treatment; August column
Final Settling: Now, I hope.

"Observation—As you report and as Ellis Tarlton of Danbury confirms, on certain occasions I have been hat-

---

STATEMENT OF THE OWNERSHIP, MANAGEMENT, AND CIRCULATION REQUIRED BY THE ACT OF CONGRESS OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, AND JULY 2, 1946 (Title 39, United States Code, Section 233)

Of *Water and Sewage Works*, published monthly at Mount Morris (Ogle County), Illinois, for October 1, 1950.

1. The names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Edward S. Gillette, 22 W. Maple St., Chicago 10, Ill.

Editor, L. H. Enslow, 155 East 44th St., New York 17, N.Y.

2. The owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.)

Gillette Publishing Co., 22 W. Maple St., Chicago 10, Ill.

L. P. Enslow, 155 East 44th St., New York 17, N.Y.

H. P. Gillette, 22 West Maple St., Chicago 10, Ill.

Winifred Gillette, 1125 Oak Grove Ave., San Marino, Calif.

Louise E. Forsythe, 410 Thayer Road, Swarthmore, Pa.

Mrs. R. W. Hume, 303 South Stone Ave., La Grange, Ill.

Provident Trust Co., 17th and Chestnut Sts., Philadelphia, Pa.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

EDWARD S. GILLETTE,
Publisher.

Sworn to and subscribed before me this 8th day of October, 1950.

(Seal) KITTIE C. WOULFE.

(My commission expires Feb. 4, 1954.)

less. *Fact*—I did own a hat, I do own a hat, and it is probable that I always shall own a hat!

"*Confusion*—Specific hats serve utilitarian purposes, but I would define hats in general as vestigal ornamental impedimenta. *Confusion worse confounded*—Hats confuse me because many magicians can produce rabbits from them, and the Danbury magicians can produce hats from rabbits.

"*Revolt*—While I respect the hat industry, I deplore the use of force to sell a product. *Reaction*—I propose, therefore, that function rather than fashion should determine the wearing of hats. Thus hats should be worn when they protect the wearer from the elements—wind, water, fire, temperature.

"*Recapitulation* — My sentiments are summarized in the words of the eminent scientist, P. T. Barnum: 'It's easy to force all the people to wear hats some of the time, and some of the people to wear hats all of the time, but it isn't easy to force all of the people to wear hats all of the time'—Cordially, Harry A. Faber."

I hate to be a spoil-sport, Harry, but didn't Lincoln say something like that—And Final Settling will come next month.

V.T.Y.—Doc.

▶ PIPE LINING FACTS NO. 1 ◀

▶▶▶ **CENTRILINE** restores the original carrying capacity of old water mains at reasonable cost by the centrifugal application of a cement lining. This smooth, dense, continuous coating defies corrosion and tuberculation. Hence, carrying capacity is sustained for the lifetime of the main.

The ever-smooth, protective lining centrifugally applied by Centriline in some instances has increased carrying capacity beyond the rate of the pipeline when originally installed. This is due to the homogeneity of the lining which covers seams, joints and rivet heads.

If mains are losing their efficiency, consult with our experienced hydraulic engineers.

CENTRILINE
PERMANENTLY INCREASES CARRYING CAPACITY

CENTRILINE CORPORATION
A subsidiary of Raymond Concrete Pile Co.
140 CEDAR STREET • NEW YORK 6, N. Y.
Branch Offices in all Principal Cities in the United States and Latin America.

Cement Mortar Linings for Water Mains
Centrifugally Applied In Strict Conformity with A. W. W. A. Specifications

Reg. U.S. Pat. Off.

▶▶▶ **WRITE TODAY FOR THE 28-PAGE CENTRILINE CATALOG**

THE SPILLWAY

[Overflow from the main section]

A Million in Five Minutes

Believed to Be a Record in Voting Water Works Bond Issue

As the third phase of a $4,000,000 water works improvement and expansion program, it took just five minutes for the City Council of Greenville, S. C., to vote $1,000,000 additional to the two earlier bond issues of like amount.

This is thought to be a record making event, which only bespeaks the thoroughness with which Supt. John Hawkins and the water department's consulting engineers, bond attorney and financial agents had prepared the proposal for council's action. Soundness of the proposal had of course been tested and established in the previous two issues of $1,000,000 each, but Supt. Hawkin's careful preparations with the assistance of an up-and-coming young South Carolina bond attorney was the key to the speedy approvals by council. And, one cannot, of course, loose sight of the confidence of council growing out of the previous history of debt retirement by the Greenville water dept., well ahead of schedule.

Sewer Revenue Bonds At Less Than 2% Make History in Pennsylvania

The city of Bethlehem, Pa., population approximately 60,000, recently was required by the Pa. Sanitary Water Board to prepare plans for a complete intercepting sewer system and a sewage plant to provide complete treatment of the sewage of Bethlehem and several adjacent municipalities.

The treatment plant has been designed for 100,000 persons contributing sewage at an average flow of 125 g.p.c.d., and will comprise duplicate comminutors; duplicate detritors; duplicate mechanically cleaned primary clarifiers; duplicate bio-filters with pumping facilities for recirculation; duplicate mechanically cleaned final settling tanks; a chlorine con-

(*Continued on page 92A*)

THE SILENT WATCHMAN

DIXIE TANK AND BRIDGE CO.

3523 LAMAR AVE. **P. O. BOX 14**
MEMPHIS 1, TENNESSEE

Complete Service for Elevated Water Tanks—
Nation Wide Service—30 Years Experience

KEEP THE SAFETY FACTOR IN YOUR TANK THE DIXIE WAY

By welding seams, pits and rivets which gives a riveted tank 15% more Safety Factor than it had when built. No rivets removed, water supply maintained while work is in progress. On completely reconditioned jobs, the painting is guaranteed for five years, repairs guaranteed for ten years, provided the tank is painted every five years by Dixie Tank and Bridge Company. Yearly inspection, making all adjustments, if any, without additional cost.

Write Us for Free Copy of Publication

SOUND PRINCIPLES OF WATER TANK MAINTENANCE and TANK TALK, by W. A. RILEY

—SAFETY—SERVICE—SATISFACTION—

COPYRIGHT 1949

THE LARGEST ORGANIZATION OF ITS KIND GIVING SAFE MAINTENANCE AT LOW COST

TENNESSEE CORPORATION
Ferri-Floc
FERRIC SULPHATE
Atlanta, Georgia

Results Count!

- **MORE ECONOMICAL**
- **EASIER TO HANDLE**
- **SUPERIOR RESULTS**

The use of Ferri-Floc in water supplies has several advantages over other coagulants now in use. Economy of operation is a great factor in the minds of prospective users, but, once used Ferri-Floc immediately shows its ability to produce a higher quality of water at a lower cost.

ADVANTAGES OF FERRI-FLOC

Coagulation is effective over a much wider pH range than with alum. Color flocs may be formed in the very acid range, where alum may not be employed. On the other hand, true hydrated ferric oxide flocs may be formed at pH 9-10, or even higher for the removal of turbidity and manganese.

2. *The time required for floc formation, conditioning, and settling is in many cases considerably shorter than that required for other coagulants.*
3. *Filter runs have been markedly increased in several cases.*
4. *Manganese is successfully removed at pH values above 9.*
5. *Effluents may be produced which are exceedingly low in both iron and aluminum.*
6. *Hydrogen sulfide is removed, and taste and odor improved.*
7. *Ferric floc does not seem to stick to sand grains to form mud balls, and is subject to less "breaking through" on the filters.*

FREE BOOKLET — Send card or letter for free booklet on the advantages of Ferri-Floc to Tennessee Corporation, Grant Building, Atlanta, Georgia or Lockland, Ohio.

TENNESSEE CORPORATION
Atlanta, Georgia — Lockland, Ohio

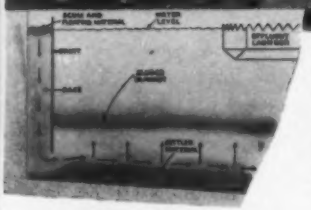
Establishing remarkable records for high purification at low cost—

YEOMANS "SPIRAFLO" CLARIFIER and "AERO-FILTER"

SINGLY . . . OR IN COMBINATION

. . . especially in the treatment of strong industrial wastes

Low construction cost . . . low operating cost . . . high purifying efficiency: these are the characteristics of the Yeomans "Spiraflo" Clarifier and the "Aero-Filter System," whether used separately or in combination.



"SPIRAFLO" CLARIFIER—Unusual functional design makes this unit a highly efficient clarifier for use in trickling filter plants . . . eliminating several non-essentials that multiply construction and operating costs. Upward flow of influent through sludge blanket increases removal of settlable and suspended solids.

"AERO-FILTER SYSTEM"—Simplified design of this high capacity biological trickling filter cuts construction costs—reduces size of required filter bed by about 85%. High efficiency of single stage operation eliminates need of installing and operating expensive conventional recirculating equipment.

FIT ANY REQUIREMENTS—Overall plant efficiency is always higher when the two units are used in combination; however, plants using either type of equipment or the combination can be designed to fit any needs for treating domestic and industrial wastes.

IMPORTANT INFORMATION—Facts as to remarkable records established by Yeomans units will be helpful in your project planning. Bulletins containing performance data, field engineering data and construction cost estimates are available on request—use the coupon.

YEOMANS

YEOMANS BROTHERS COMPANY
1423 North Dayton Street
Chicago 22, Illinois

Please send these bulletins:
☐ No. 6570—"Aero-Filter"
☐ No. 6790 "Spiraflo" Clarifier

Name _____
Company _____
Address _____
City _____ State _____

(Continued from page 90A)

tact tank; duplicate heated primary and secondary sludge digestion tanks with gas collection; vacuum filters; sludge drying and incineration facilities; a control building fully equipped with laboratory facilities; and an outfall sewer to Saucon Creek near its confluence with the Lehigh River.

The project is being handled by the newly created Bethlehem Sewer Authority set up by the city. The Authority has advertised, and a contract for the construction of the intercepting sewers and sewage plant has been awarded in the amounts of $1,751,672 for the intercepting sewers and $2,582,918 for the sewage plant. The Authority has sold a $5,000,000 issue of 38-year sewer revenue bonds. These serial bonds were sold at the attractive average interest rate of 1.99%, constituting the lowest interest rate on this type of bond that has been sold in Pennsylvania to date, and indicating the strong financial status of sewer revenue bonds backed by the recently legalized political subdivisions known as Water Authorities and Sewer Authorities.

MANUFACTURERS' and EQUIPMENT NEWS

1101

Hydraulic-Pressure Electric Switch

Pantex Manufacturing Corp., Pawtucket, R.I., has recently announced a new, cartridge-type hydraulic pressure electric switch.

Designed for the precise control of electric circuits by means of hydraulic-pressure actuation, this switch will cut-in and cut-out electric circuits with as little as 12 to 18 percent pressure differential. Unaffected by extreme pressure surges, temporary or sustained, the unit has also withstood a wide temperature differential ranging from —65° F. to +160° F. without loss of accuracy or other desirable operational characteristics. The design of this unit eliminates failure due to either mechanical or

(Continued on page 94A)

For a copy of a bulletin or catalog mentioned on this page, mail a Reader Service Card with your name, address, and key number of the item.

Now you can machine
TRANSITE PIPE
on the job
with **PILOT**
MACHINING TOOL

Now a simplex coupling can be used at any point where pipe is cut. Save time in the field and utilize all odd lengths.

Duplicate factory machining in the field or shop on asbestos–cement pressure pipe with this specially engineered hand tool–for all pipe classes through 8" nominal (10" O. D.)

Shipping weight 17 lbs.
List price . . $78.00
freight added

Cuts PRESSURE PIPE TOO!

Ask about the new Model 4 Pilot Pipe Cutter. Saves time—money. Easy to use . . . fast—accurate.

at your supplier or write:

PILOT *Manufacturing Company*
420 MARKET STREET SAN FRANCISCO 11 CALIFORNIA
Distributors wanted. Write for details.

WATER LEVEL CONTROL
Never Sleeps
Never Forgets

Maintains exact levels to 1/100 of an inch in **Water Tanks—Reservoirs—Settling Basins—Boilers—**

Lumenite Electronic
LIQUID LEVEL CONTROL

To Pump Motor, Motorized Valves, Solenoid Valves, Etc.

Has **no moving parts**—no **floats**—Operates electronically with 1/10000 Amp. impulse. Just two steel rods in container—nothing else. Controls directly pump motors, motorized valves. Simple installation. Practically no up-keep.

Write for Engineering bulletin No. 421

Lumenite Electronic Company
ENGINEERS · DESIGNERS · MANUFACTURERS
407 S. Dearborn Street Chicago 5, Ill.

Because it's BLAW-KNOX "TWISTED BAR" Electroforged Steel Grating

Blaw-Knox Stair Treads available with rolled diamond checker plate nosing, twisted cross-bar nosing or abrasive nosing.

THE twist does the trick—twisted bar construction gives greater traction, makes slipping impossible even if the grating is wet, greasy or icy. The slightly roughened surface grips shoe soles for *extra* safety, yet the over-all surface is level. Trucks and other wheeled vehicles roll freely. In addition, Blaw-Knox Steel Grating is electroforged into one piece for extra strength and durability.

OTHER ADVANTAGES: Maximum open area for light and air. Self-cleaning, easy to maintain, economical to install.

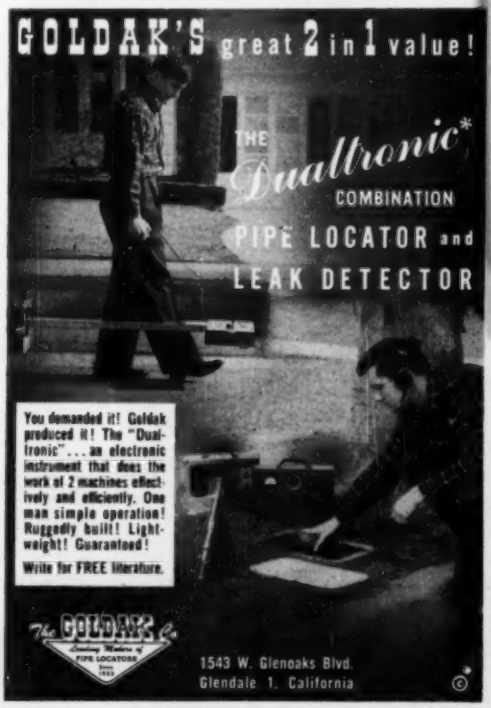
GET THE FACTS FROM BULLETIN 2296

Big new bulletin gives complete details, specifications, possible applications and all the outstanding advantages of Electroforged Steel Grating and Stair Treads. Write for your copy today!

BLAW-KNOX DIVISION of Blaw-Knox Company
2051 Farmers Bank Bldg., Pittsburgh 22, Pa.

BLAW-KNOX ELECTROFORGED STEEL GRATING

GOLDAK'S great 2 in 1 value!



You demanded it! Goldak produced it! The "Dualtronic"... an electronic instrument that does the work of 2 machines effectively and efficiently. One man simple operation! Ruggedly built! Lightweight! Guaranteed!

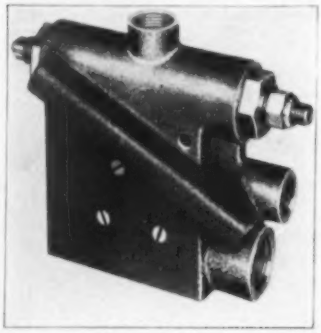
Write for FREE literature.

The GOLDAK Co.
Leading Makers of PIPE LOCATORS Since 1933

1543 W. Glenoaks Blvd.
Glendale 1, California

(Continued from page 92A)

hydraulic shock and operates immediately with every start of the pump as it requires no pressure build-up. It can be quickly and easily adjusted without breaking the line and if desired an added feature of pre-set switch limitations is available.



Golden Anniversary of Niagara Alkali

Niagara Alkali Co., New York, N.Y., marks its Fiftieth Anniversary this year, according to J. Clarke Cassidy, President.

Organized in 1900, under the name of the Roberts Chemical Co., Niagara has pioneered steadily in its field of electrochemistry, specifically in relation to chlorine and similar products.

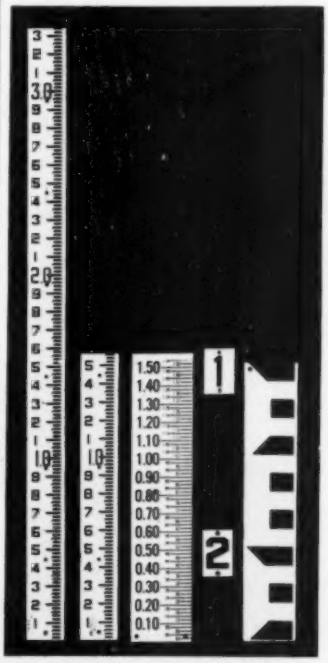
A notable contribution of the company has been to public health through the chlorination of water supplies. On November 22, 1912, the company tried out the first successful apparatus for this purpose, in the City of Niagara Falls. Another first for Niagara Alkali was the successful introduction of liquid chlorine for bleaching cotton textiles.

Niagara Alkali started with the ideas and some 30 patents of Isaiah L. Roberts, principal of which was an electrolytic cell diaphragm to withstand the destructiveness of basic chemical compounds in making caustic potash and bleaching powder.

1102

Inexpensive Staff Gages

Leupold & Stevens Instruments, Inc., Portland, Ore., has introduced an inexpensive staff gage for measuring water or any liquid level.



The staff gages, which are available for as little as $1.00 in a variety of lengths and widths, are designed so as not to affect the flow of liquid. They are porcelain enameled and accurately graduated in English or metric system. These gages are guaranteed against rust or discoloration.

Erven Appointed By Kennedy Valve

Kennedy Valve Manufacturing Co., Elmira, New York, has appointed James R. Erven as salesman in the

SOLVAY

FOR WATER CONDITIONING

Free Technical Literature Available on Request

Bulletin No. 7—"Liquid Chlorine"

Bulletin No. 8—"Alkalies and Chlorine in the Treatment of Municipal and Industrial Water"

Bulletin No. 11—"Water Analysis"

For Water Softening
...SOLVAY
Soda Ash

For Water Purification
...SOLVAY
Liquid Chlorine

For Water
Technical Service
...call SOLVAY

SOLVAY SALES DIVISION
ALLIED CHEMICAL & DYE CORPORATION
40 Rector Street • New York 6, N. Y.

BRANCH SALES OFFICES

Soda Ash · Caustic Soda · Chlorine · Caustic Potash
Potassium Carbonate · Calcium Chloride · Sodium Bicarbonate · Specialty Cleansers
Sodium Nitrite · Nytron · Ammonium Bicarbonate · Para-dichlorobenzene · Ortho-dichlorobenzene
Monochlorobenzene · Methanol · Ammonium Chloride · Formaldehyde

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

states of Louisiana, Mississippi and part of Alabama.

Before joining the Kennedy organization Erven, a navy veteran of World War II, was employed by the Calmes Engineering Co., New Orleans, and the Tampa Shipbuilding Co., Tampa, Fla.

1103

Metering Element for Fluid Flow

Foster Engineering Co., Union, N. J., has available the Foster "Flow Tube." This "Flow Tube" is a new development in primary elements for the measurement and control of fluid

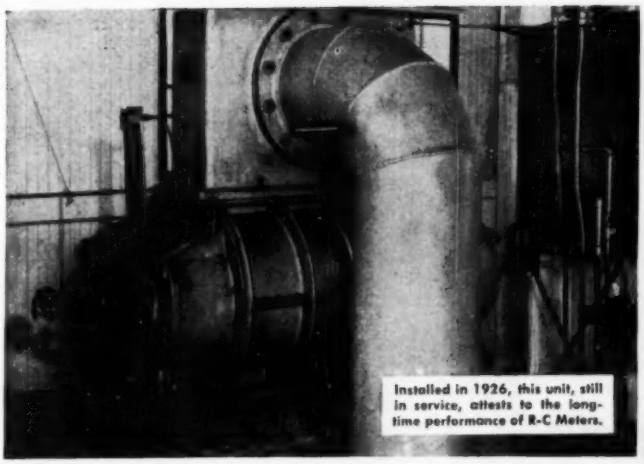
flow. It is essentially a differential producer which can be used with properly calibrated conventional recording, indicating, integrating, or control instruments.

The device consists of a short spool piece with an inner sleeve equipped with two groups of pressure nozzles, one set pointing upstream and the other downstream. These nozzle groups are interconnected by common pressure rings from which connections are made to the meter.

Flow tubes are made in three fundamental types and in all standard pipe sizes. Advantages claimed are compactness, high accuracy and economy of installation and use.

Atlas to Continue Study of Behavior of Sulfur Joint Compounds

In the belief that lack of information is to a major degree the cause of the confusion which continues to exist on the use of sulphur compound joints in cast-iron pipe, The Atlas Mineral Products Co. of Mertztown, Pa., has decided, on the basis of the excellent results obtained to date, to continue its research project on the



NO PENSION FOR THIS OLD-TIMER even after *23* years of service

Accurate and dependable as always, this 23-year-old Roots-Connersville Meter still performs faithfully. No retirement for this veteran! Because new demands called for higher capacity, it has been transferred to another job in the same plant. Its old duties have been taken on by a new R-C unit, purchased because of fine performance of this old-timer.

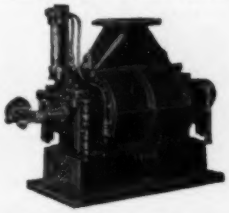
That's a common history of R-C Meters. They're built to measure accurately, and keep on doing it, year after year. Simple design, finely machined measuring surfaces and other important refinements account for their ability to measure gas accurately and unfailingly, almost indefinitely.

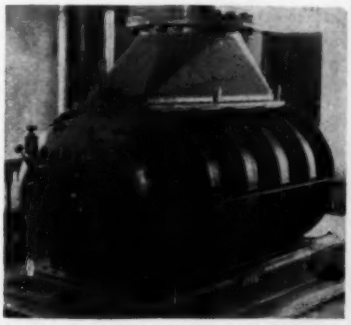
With 31 standard sizes and capacities from 4,000 to 1,000,000 cfh, R-C Meters meet the needs of most applications. Write for Bulletin 40-B-14 or tell us your specific requirements.

ROOTS-CONNERSVILLE BLOWER CORPORATION
511 Mount Avenue, Connersville, Indiana

(Right) This R-C Meter, with capacity of 317,000 cfh, replaced the "old-timer" above, now transferred to other duties.

(Below) Typical small capacity R-C Meter for low and medium pressures.





ROOTS-CONNERSVILLE
BLOWER BUILDERS SINCE 1854
ONE OF THE DRESSER INDUSTRIES

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

fundamentals of sulphur joint compounds.

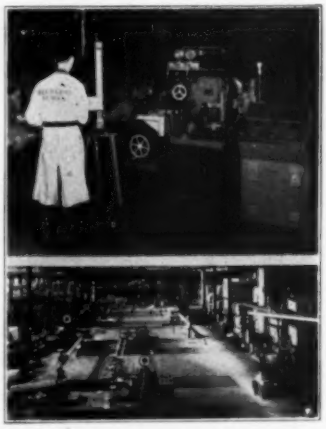
This project, known as 1A4, was set up over a year ago by Atlas in response to a request by the American Water Works Association that a research program to develop basic information on sulphur joint compounds be undertaken.

The project is under the supervision of Dr. Raymond B. Seymour, Technical Director, assisted by Dr. Robert H. Steiner, Research Coordinator and Walter R. Pascoe, Research Chemist. Working with Atlas on this project are members of the Civil Engineering Department of Lehigh University under the direction of Professor W. H. Eney with associates, Dr. A. C. Lower, Dr. R. D. Stout and Mr. K. Muhlhausen.

This information has come to us from Geo. L. Wirtz, President of Atlas Mineral Products Co.

Peerless Pump New Test Lab.

Peerless Pump Division of the Food Machinery and Chemical Corp., Los Angeles, Calif., has announced the completion of a new pump testing laboratory at its Indianapolis Works, Indianapolis, Ind.



Peerless Pump Testing Laboratory, Indianapolis, Ind.

(Above: One of eight test stations. Below: General view showing all test stations)

The installation, finished in August, involves a consideration of over a quarter million dollars and establishes a completely new set of standards in pump testing procedures in this field. The laboratory occupies more than 7,000 square feet of floor area and includes a total of eight pump stations. Both high and low voltage equipment is available, making use of motors up to 1,000 hp. in size.

The Peerless test laboratory is designed for a capacity of more than a half million gallons of water, believed to be the largest in the United States. The water test pit is 30 feet wide by 192 feet long and 12 feet deep and at one end of the pit a round pit 10 feet in diameter and 40 feet deep was installed to make it possible to test vertical pumps.

1104

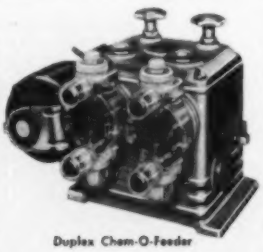
Flocsettler Unit

American Well Works, Aurora, Ill., has engineered and manufactured a modern "American" Flocsettler for turbidity removal, water softening and waste treatment.. It contains, in one compact unit, all of the modern features of water and waste treatment including mixing and slurry blending, slurry recirculation, sludge blanket settlings, sludge concentration and positive sludge removal.

The water or waste enters into the rapid mix and blending zone and then flows through the circulation unit into the flocculation or softening zone. Because the capacity of the circulating

When you need pure, potable water in a hurry you can't beat %Proportioneers% Pur-O-Pumper! Construction crews, civilians, and the armed forces count on %Proportioneers% for clear, safe water wherever they work or fight. The Pur-O-Pumper is a triple-duty unit — (1) it pumps its own water supply from any stream or pond, (2) it sterilizes every gallon in proportion to flow, and (3) it filters the water through a highly efficient, diatomaceous earth filter. In peace or war, the Pur-O-Pumper is ready for service — it is entirely self-contained, easily portable . . . easy to set up wherever required.

The heart of the Pur-O-Pumper is %Proportioneers% Duplex Chem-O-Feeder, proven in thousands of installations for general purpose feeding. It feeds hypochlorite solution for sterilization and slurry for body coating the Pur-O-Cel Diatomaceous Earth Filter. The Pur-O-Pumper incorporates %Proportioneers% famous Pur-O-Cel Filter that has long been used in leading bottling plants and swim pools, and is now being used in municipal water plants.



Duplex Chem-O-Feeder

Be ready for any emergency — write today for information.

% PROPORTIONEERS, INC. %

350 HARRIS AVE., PROVIDENCE 1, R. I.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

unit is adjustable to a rate greater than the inflow, there is always a slight differential between the water surfaces of the blending zone and the quiescent settling zone. This difference in hydrostatic pressure provides positive slurry recirculation. Slurry return can easily be controlled and actually measured. This provides the designing engineer and operator with a means for maintaining optimum treatment regardless of fluctuating flows or varying water quality.

Blanchard Sales Engineer for Rensselaer

Rensselaer Valve Co., Troy, N.Y., has announced the appointment of Kimball Blanchard as sales engineer for the New York District, replacing James M. Robinson, who recently resigned.

Mr. Blanchard attended Cornell and Columbia Universities and served in the Army Air Force during World War II. Prior to joining Rensselaer, he was associated with the Crane Co.

1105

Single-Strap Pipe Clamp

Smith-Blair, Inc., South San Francisco, Calif., has developed a new type single-strap clamp for making lateral pipe connections to branch and

main pipelines. This new product makes unique use of special shaped molded rubber and oil resistant type gaskets to effect a leak-proof seal for the clamp that is perhaps better described as taper sealing.

A principal feature is a wedging action of the resilient gasket which develops partly from hydraulic pressure within the pipe plus only a mod-

WARREN
Solves Your
PIPE
PROBLEMS
BELL & SPIGOT PIPE •
FLANGE PIPE •
MECHANICAL JOINT PIPE •
FLEXIBLE JOINT PIPE •
SPECIAL CASTINGS •
SHORT BODY BELL & SPIGOT SPECIALS •
Warren Cast Iron Pipe and Fittings can be supplied in all sizes 2" to 84" with all types of joints and in accordance with Standard Specifications. Specify "Warren Pipe" for your next job.
Take advantage of our large stock of non-standard patterns, when in need of special castings to meet your individual requirements.
Warren
FOUNDRY & PIPE CORP.
55 LIBERTY ST. — N. Y. C.
WARREN PIPE CO. of MASS. INC.
75 FEDERAL ST., Boston, Mass.

Since 1886

"Ebony Paint Kills Rust"

A Refined Coal Tar Base Paint

No matter how old the job—5 to 25 years—rust has never been found under EBONY PAINT.

Specified by many Engineers for Sewage Disposal and Water Plants.

Quart sample and literature on request.

Ebony Paint Manufacturing Co.
18th & Agnes Ave.
KANSAS CITY 1, MISSOURI

STOP WATER SEEPAGE SEWAGE CORROSION

WITH FORMULA No. 640

a clear liquid penetrating (1"+) sealer for concrete and masonry preventing water absorption and reducing the action of acids. Holds 12' hydrostatic head. Use our Hayproc Rubberized Enamel for color on walls and floors—not affected by concentrated acids, alcohol, oil, or traffic abrasion.

30 OTHER PRODUCTS
Write for technical data.

Haynes Products Co., Omaha 3, Nebr.
See our file in Sweet's

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

erate tightening of the strap nuts. The taper seal idea was developed for use on asbestos-cement pipes but is now in production for light wall steel pipes. Extra-wide arc saddles are said to avoid the extreme crushing pressure formerly required to properly seat metallic type gaskets.

Paul Cerny Joins Dorr Co.

Announcement has been made by the Dorr Co., Stamford, Conn. of the appointment of Paul J. Cerny as Sales Engineer in the Eastern Sanitary Division. Mr. Cerny will be lo-

cated in the New York office with Allen Darby.

Cerny, a graduate of Iowa State, worked with the State Departments of Health in Kansas and Indiana and the Pacific Flush Tank Co., with whom he was associated before joining the Dorr Co. last summer.

1106

Multi-Purpose Utility Drill

Gardner-Denver Co., Quincy, Ill., has announced a new lightweight utility drill for plant maintenance

crews. The S17 utility drill comes in a handy carrying case with complete kit of drill accessories, including a 14-inch drill steel and three assorted-size rock bits, a star drill adapter and 25 feet of air hose.

According to reports it is a full-fledged, self-rotating pneumatic hammer drill that weighs only 19 lbs., and will drill either concrete, brick or stone with standard drill steel, and with adapter, will accommodate standard star drills. A special stop-rotation feature converts the S17 to a lightweight chipping hammer or pick.

Jack Cooper Joins DuBois Organization

"Jack" Cooper who has made a name for himself as the Industrial Waste Consultant of the Ford Motor Co. and who has long been active in the affairs of the Michigan Sewage Works Assn. has left the Ford Company to become a member of the firm of Manufacturer's Agents, the F. W. DuBois Co.

Jack will also be remembered as the head of the Industrial Waste Disposal School conducted a few years ago at the University of Michigan. According to Jack he has long thought of going into sales engineer-

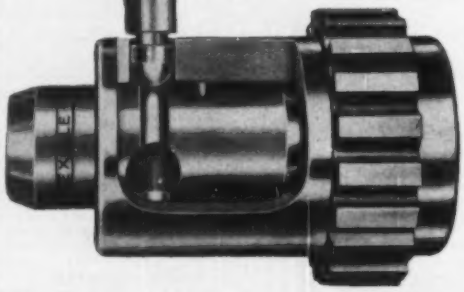
(*Continued on page 99A*)

NEW "FLEXIBLE" COUPLING

Cut-away above shows compartments into which each elbow bend fits

New "Flexible" couplings are completely interchangeable with all "Flexible" couplings made in the last 15 years

LOCK PIN LOCATOR



Simply move coupling in or out of ratchet or power drive shaft, and press point of pin down until it clicks. Then turn right or left for hole. What could be easier?

Redesigned for faster, simpler, time-saving coupling-up. Impossible now to couple into lock pin hole. Rods cannot come apart in sewer line.

WRITE TODAY FOR ILLUSTRATED LITERATURE

FLEXIBLE SEWER-ROD EQUIPMENT COMPANY

9059 Venice Blvd., Los Angeles 34, California

AMERICA'S LARGEST MANUFACTURER OF PIPE CLEANING TOOLS

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

READER SERVICE CARDS for

WATER & SEWAGE WORKS

Equipment — Products
Information — Literature

JUST
CLIP
THESE
CARDS
MARK
AND
MAIL —
TO
RECEIVE
THE
LATEST
INFORMATION
OR
LITERATURE
DESCRIBED
IN
THIS
ISSUE

Place Stamp Here

WATER & SEWAGE WORKS
135 East 44th Street
New York 17, N. Y.

Reader Service

Place Stamp Here

WATER & SEWAGE WORKS
135 East 44th Street
New York 17, N. Y.

Reader Service

Write key number of item you desire here →

Your name .....

Title .....

Company or Dept. .....

Address .....

WATER & SEWAGE WORKS READER SERVICE

Write key number of item you desire here →

Your name .....

Title .....

Company or Dept. .....

Address .....

WATER & SEWAGE WORKS READER SERVICE

Write key number of item you desire here →

Your name .....

Title .....

Company or Dept. .....

Address .....

WATER & SEWAGE WORKS READER SERVICE

Write key number of item you desire here →

Your name .....

Title .....

Company or Dept. .....

Address .....

WATER & SEWAGE WORKS READER SERVICE

Write key number of item you desire here →

Your name .....

Title .....

Company or Dept. .....

Address .....

WATER & SEWAGE WORKS READER SERVICE

Write key number of item you desire here →

Your name .....

Title .....

Company or Dept. .....

Address .....

WATER & SEWAGE WORKS READER SERVICE

READER SERVICE CARDS HOW TO USE THEM

Please fill out a separate coupon for each item on which you desire information. This will greatly facilitate handling.

Key number is at head of each new product, item of equipment, catalog or bulletin, described in this issue.

Enter key number in box.

Please PRINT your name and title, company or department name, and your address

NOTE—

These cards are to be used only for items described in THIS ISSUE

WATER & SEWAGE WORKS

Will see that you receive information desired.

(Continued from page 98A)

ing and when he learned that "Duke" DuBois was launching a new company, specializing in Jack's field, he decided to go into the organization. The organization, will henceforth be called DuBois-Cooper Associates and will specialize in Fluid meters, flow controllers, sewage and industrial waste treatment equipment, and valves of many kinds.

The firm is located at 15760 James Couzens Highway, Detroit, Mich.

Neptune Appoints W. Smith

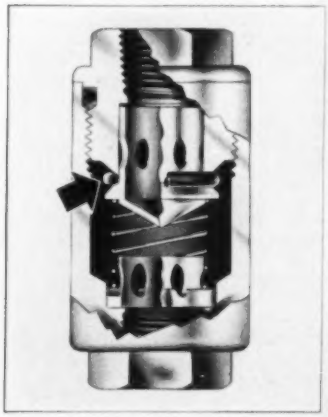
Neptune Meter Co., New York, N.Y., has announced the appointment of Wentworth Smith as Assistant General Sales Manager. Mr. Smith, who has been connected with the company for a number of years, replaces James H. Judge, who recently resigned.

Mr. Smith, a graduate of Williams College, also attended Yale Graduate School. He served five years in the U. S. Army Quartermaster Corps, leaving as 1st Lieutenant and having seen service in the South Pacific and Alaska.

1107

Leak-Proof Check Valves

James-Pond-Clark, Pasadena, Calif., have announced a new line of Circle Seal Check Valves guaranteed not to leak. These are now made



available as standard catalog items in a full range of sizes from ⅛ to 1 inch NPT. Two models are available—designed for standard and very low pressure systems; both are poppet type using an "O" ring seal. Absolute sealing, minimum flow resistance, and leakproof dependability for pneu-

You Take it Apart
See for YOURSELF the Unusual SIMPLICITY of Buffalo-made American Water Meters
AMERICAN (Bronze Case) WATER METERS
NIAGARA (Galv. Iron Case) WATER METERS
Only five submerged moving parts — only one moving part in the measuring chamber. No meter built in the United States today is as simple in design. The simplicity of American Meters means long service, low repair cost and smaller inventory of parts.
BUFFALO METER CO.
2909 MAIN STREET, BUFFALO 14, N. Y.

ZECO
GREENSAND
ZEOLITE
ZECO and HI-ZECO Greensand Zeolite for water softening, filtration and iron removal. ZECO Manganese Zeolite for iron and manganese removal. COREXITE mineral for corrosion control and water stabilization.
ZEOLITE CHEMICAL CO.
Sales Office 140 Cedar St., New York, N.Y.
Factory Medford, N.J.
Pioneer Producer of GREENSAND ZEOLITE MINERAL

Phipps & Bird
LABORATORY MIXER
IS the important piece of equipment in the Modern Water Works Laboratory. Now being used by leaders in water works research. Many superintendents and chemists have been able to reduce their chemical costs by the control of chemical dosages with this mixer. Write for literature.
PHIPPS & BIRD, INC.
Richmond, Va.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

matic and hydraulic systems are features of the new line, according to the manufacturer.

The unique operating principle utilizes a synthetic rubber "O" ring between conical surfaces on the poppet and valve housing. As the line pressure works against the outer periphery of the "O" ring, increased line pressure greatly increases the sealing pressure.

Opening pressures are as low as 1 psi differential in the standard pressure types and 4 inch water column in the low pressure types. Poppets close at zero flow before return flow starts.

New Penn Salt Sales Mgrs.

Penn Salt Mfg. Co., Philadelphia, Pa., has announced the appointment of George D. Grogan and Donald Macfarlan, Jr., as district sales managers in Chicago and Detroit, respectively.

Mr. Grogan formerly was a product supervisor in the Philadelphia office and Mr. Macfarlan formerly was a sales representative in the Paterson, N.J., office. H. G. Potts, formerly district sales manager in Detroit, has ben named supervisor of technical service for the midwest areas. H. A. Smith, formerly district manager in Chicago, has been given special assignments in the heavy chemical field in the Chicago area.

A. P. Smith Co. Appoints J. M. Robinson

The A. P. Smith Mfg. Co., East Orange, N.J., has announced the appointment of James M. Robinson of

Hornell, New York as Sales Engineer in New York, New Jersey territory, effective Sept. 1, 1950.

Mr. Robinson is well known to the members of the water works profession. Previous to his affiliation with the A. P. Smith Mfg. Co., he was associated with Rensselear Valve Co., the Curtiss-Wright Co., and the Sterling Engine Co.

Mr. Robinson replaces T. L. Halpin who resigned from the company on May 1, 1950.

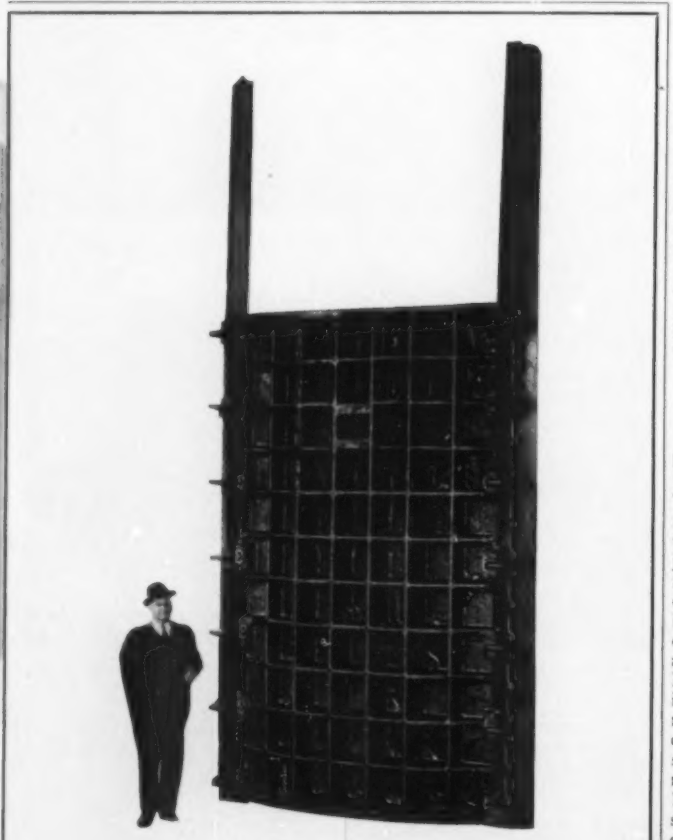
1108

Nipple Chuck

The Ridge Tool Co., Elyria, Ohio, has developed a new Nipple Chuck for the threading of short nipples. This chuck is of simple design which fits any threading machine or vise without special tools, parts or adjustments, according to the manufacturer. It requires no adjusting or changing of the stop plug which is an integral part of the nipple chuck, and is said to be always automatically in position for use. Nipples to be threaded are screwed in by hand, and after threading, released instantly by an easy turn of the chuck, so they can be unscrewed by hand. Pipe adaptors are made for ¼, ⅜, ½, ¾, 1, 1¼, and 1½ inch pipe; the nipple chuck itself holds 2 inch pipe. A handy carrier is furnished with each complete set.

Byers Appoints Binder

A. M. Byers Co., Pittsburgh, Pa., announced the appointment of W. J. Binder as manager of the Engineering Service Department. Mr. Binder, an engineering graduate of the University of Pittsburgh, has been with the Byers organization since 1946.



FILER & STOWELL SLUICE GATES

are built to stand long trouble free service. Amply proportioned for all stresses of shipment, erection and operation. They may be obtained with manual, hydraulic cylinder or motor operating controls.

THE FILER & STOWELL COMPANY
MILWAUKEE 7, WISC.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

1109

Electrifugal Pump

Allis-Chalmers Manufacturing Co., Milwaukee, Wis., has announced a redesigned close-coupled Electrifugal pump and motor with internal and external design changes to provide improved operating characteristics and greater ease in maintenance.

The improved unit has new sealed motor bearings; a unit-cast frame which provides perfect and permanent alignment; double seal on front motor bearing which keeps liquid out of the bearing under normal conditions, and a large opening in the frame between the pump and motor to make packing maintenance quick and easy. It can be had in ratings from 10 to 500 gpm. at heads up to 220 feet.

Carter Products Changes Name

Carter Products Corporation, Cleveland, Ohio, has announced that the company name has been changed to Carlon Products Corporation. This change, effecting only the corporate name, is in line with company policy to consolidate all products and facilities under the trade-name Carlon, which is gaining nation-wide acceptance in all fields of industry. Sales of Carlon extruded plastic products have increased so rapidly within the past nine months that it has become necessary to establish a new plant in Corsicana, Texas.

Foxboro Opens Two Offices

The Foxboro Co., Foxboro, Mass., has announced the opening of two new branch offices. This brings the total of its domestic offices to 39, of which three include branch factory facilities.

The newest addition to the list is the branch office at 214 W. 10th St., Wilmington, Del., under the managership of Kenneth L. Barton, who has been with the Foxboro Co., for 25 years.

Earlier this year an office was opened at 225 S. 5th St., Minneapolis 2, Minn., with Robert C. Cahill as Resident Engineer, but the mounting volume of business also prompted the opening of a full-scale branch office at Appleton, Wis.

Coonley Heads ACF Valve Division

American Car and Foundry Company's president, Charles J. Hardy, Jr., has announced the appointment of John C. Coonley as manager of the company's Valve Division.

FROM UNWANTED SLUDGE TO SALEABLE FERTILIZER

. . . DIRECT FROM PILE TO TRUCK

Unwanted sewage sludge must be burned or hauled away for disposal *unless* it is processed into a marketable, useable fertilizer. A Royer Sewage Sludge Disintegrator does just that – quickly and economically. Sludge with as much as 56% moisture content is shovelled into the hopper where it is shredded, pulverized, aerated and loaded directly into truck or bags. A thoroughly mixed, finely granulated fertilizer with chemicals added if desired, is the result . . . fertilizer ready for immediate use by florists, parks or golf clubs. Thus an item of expense is turned into a source of income.

Write for our free booklet giving all the information on the Royer Method of Sludge Disposal. Complete details will be sent you on sizes and models available.

Royer Sludge Disintegrator in use at a Wisconsin Sewage Disposal Plant.

ROYER — PIONEERS IN THE SALVAGE OF SEWAGE SLUDGE

ROYER FOUNDRY & MACHINE CO.

170 PRINGLE ST., KINGSTON, PA.

ANTHRAFILT

Trade Mark Reg. U. S. Patent Office

A Filter Medium For All Purposes

ANTHRACITE EQUIPMENT CORP.

Anthracite Institute Building

Wilkes-Barre, Pa.

All correspondence regarding sales and engineering should be addressed to:

PALMER FILTER EQUIPMENT CO.

822 E. 8th St. Erie, Pa.

Engineers and Sales Agents

STOP JOINT LEAKAGE USE

CARSON CLAMPS

With Pearlitic C.I. Bolts for Cast Iron Pipe and Fittings.

Write for Prices.

Carson-Cadillac Co.

1221 PINSON ST. BIRMINGHAM, ALA.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Mr. Coonley succeeds W. R. Kottsieper, who is retiring after more than 44 years of service with ACF. He was with the Walworth Co., as salesman, engineer and tool design superintendent for many years prior to coming to ACF in June of this year as assistant manager of the valve division.

1110

Santa Fe Tank & Tower Forum Series

Santa Fe Tank & Tower Co. has just recently initiated a series of nation-wide engineering forums to acquaint practically all phases of American industry with the latest concepts of cooling tower design, construction and operation. Of equal importance is the reverse effect of these informal sessions. From a research standpoint, Santa Fe is able to obtain various reactions and suggestions to specific engineering problems . . . and are quick to apply this information to the design of their equipment.

The first of these forums was conducted at Denver, Colorado by Dr. N. W. Snyder, consulting engineer for the Santa Fe Tank & Tower Company. Approximately 50 oil, power and chemical engineers attended this meeting.

A second forum was held in Los Angeles and similar meetings, scheduled for the remainder of this year, will be held in San Francisco, Tulsa, Houston, Dallas, El Paso, Phoenix and Chicago. Transcripts of these forums will be available and may be had by mailing a Reader Service Card with the above key number.

For safety's sake choose Builders Visible Flow Chlorinizer. No other chlorine gas feeder offers better protection, quicker protection, more reliable protection against the escape of chlorine gas. Night and day, the powerful spring-loaded chlorine control valve keeps chlorine gas flowing under complete and exact control . . . yet it's ready at all times to shut off the flow automatically should any condition occur to interfere with safe operation of the Chlorinizer. This is another of the many worthwhile features you get only with Builders Chlorinizer. For engineering information and Bulletins, address Builders-Providence, Inc., 350 Harris Ave., Providence 1, R. I.

BUILDERS PRODUCTS: The Venturi Meter • Propelofio and Orifice Meters • Kennison Nozzles • Venturi Filter Controllers and Gauges • Conveyoflo Meters • Type M and Flo-Watch Instruments • Wheeler Filter Bottoms • Master Controllers • Chlorinizers — Chlorine Gas Feeders • Filter Operating Tables • Manometers • Chronoflo Telemeters

Installation at Simsbury, Conn.

BUILDERS PROVIDENCE
Instruments

1111

Ion Exchange Resin

The Resinous Products Division of Rohm & Haas Co., Philadelphia, Pa., has added a new medium-capacity cation exchange resin, designated as Amberlite IR-105G. The new exchanger combines the hydraulic behavior of Amberlite IR-100 with the high capacity and regeneration efficiency of IR-105. It has therefore replaced those products in the company's series of ion exchange resins. The new IR-105G is a phenolic type resin furnished in granular, rather than beaded form, which gives it improved hydraulic characteristics.

National Supply Appoints Stubble, Woods

National Supply Co., Pittsburgh, Pa., has announced the appointment of Clarence J. Stubble as Assistant Manager of the company's Eastern Division with headquarters at Pittsburgh. At the same time the company made known the appointment of J. C. Woods as Asst. Manager Eastern Div. with headquarters at Toledo, Ohio.

Mr. Stubble has been with National Supply since 1934 when he joined them at Bolivar, N.Y. as a store clerk, and has held positions of store manager, field salesman and district manager before moving to his new position.

Mr. Woods joined the company in 1944 and was sales representative at Houston, Texas, before assuming his new position.

1112

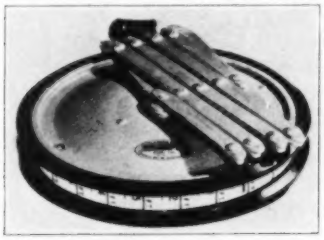
New Lightweight Tape

Rolatape, Inc., Santa Monica, Calif., has announced a new, lightweight rolatape for accurate one-man measurement, vertically, horizontally or around curves.

The new unit, the manufacturer states, permits safe and accurate measurements of from a few inches

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

to almost unlimited lengths by a single individual. Recessed tape face on rim of wheel indicates measurement in fraction of inches up to 2 feet.



Automatic counter clocks measurements in feet and in cycles of 100 feet. In operation, an audible click is made for every two feet measured and a bell rings at the 100-foot mark.

A lightweight handle collapses down to 8 inches when not in use so that complete unit can be carried in glove compartment of any automobile.

LITERATURE AND CATALOGS

1113

HAND TOOLS—THEIR MAINTENANCE & CARE

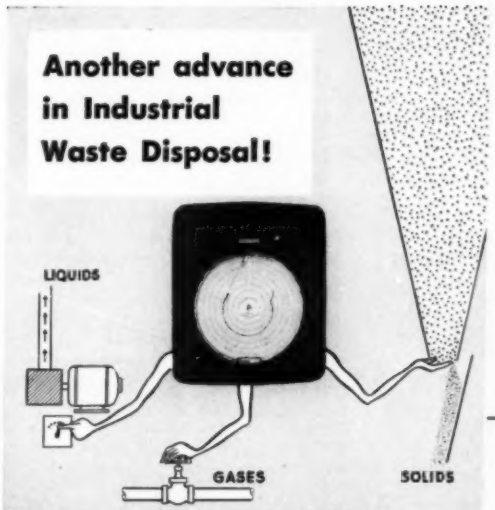
Small tools are frequently an item of considerable expense in the operation of water and sewage systems. Likewise the efficiency of a mechanic depends to a goodly extent on the tools which he has to work with, and their condition when he does have them. Consequently, managers of water and sewage works, plant superintendents and foremen will find of value a booklet of recent production by the U.S. Government which is devoted to the correct methods of care and maintenance of hand tools. The brochure covers the general care, repair, sharpening, hardening, tempering, storing, etc; the common misuses and abuses of hand tools in general, and methods of correcting such. The brochure (116 pages and illustrated) is procurable for 30 cents in coin (not stamps) from the Supt. of Documents, U.S. Gov't Printing Office, Washington 25, D.C. Request Catalog W-1.35:9-867.

1114

FLOCSETTLER

American Well Works, Aurora, Ill., has just published a new technical supplement on the **"American" Flocsettler**—Water Treatment Unit.

Another advance in Industrial Waste Disposal!



AUTOMATIC CONTROL for Proportioning of Treating Chemicals

Feeding of treating chemicals at rates proportionate to flow can *now be done automatically*— with total elimination of time-consuming, periodic adjustment of feeders and pumps. In addition, the proportioning of chemicals is far more accurate, which means a more uniform, satisfactory effluent and a definite saving in cost of chemicals.

The instrument control system is properly engineered for individual plant conditions. Its design depends upon the quantity, corrosive quality, and viscosity of the activated silica, carbon dioxide, soda ash, lime, or other chemicals employed . . . also upon the amount of chemicals to be stored and the type of plant operation.

Virtually *any* set of conditions can be met with one or another of the following instrument control methods offered by Foxboro:

1. *ratio flow control with pneumatic control valves for liquid chemicals or gases*
2. *control of motor operation on dry feeders or on proportioning pumps by "pulse-time" control*
3. *motor speed control on dry feeders or proportioning pumps through electronic control of power input.*

One of these methods may bring substantial new economies to the operation of your waste disposal system. For engineering briefs on industrial waste surveys, chemical control systems, and disposal methods, write **The Foxboro Company, 228 Neponset Ave., Foxboro, Mass., U. S. A.**

FOXBORO *Instrumentation*

INDICATING · RECORDING · CONTROLLING

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

SPARLING

Main-Line Meters

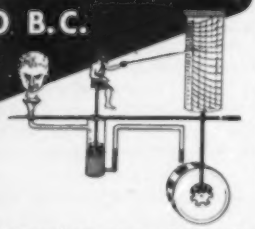
Your best buy for metering lines from 2-inch up is shown, with price and data, in Sparling Bulletin 310, which is free upon request.

SPARLING METER COMPANY

LOS ANGELES • CHICAGO • BOSTON
CINCINNATI • DALLAS • SEATTLE
NEW YORK

WATER at WORK

250 B.C.



A far cry from modern applications, this unique time piece known as the Water Clock of Ctesibius was operated by tears flowing from the eyes of a statue. The Pointer descended once in 24 hours, actuated by an automatic siphon.

for excellence in MODERN water treatment equipment—gravity and pressure filters—recirculation apparatus

MECHANICAL EQUIPMENT BY ROBERTS FILTER MFG. CO. DARBY, PENNA.

ROBERTS FILTER MANUFACTURING CO.
607 COLUMBIA AVE., DARBY, PA.

This 8 page supplement, profusely illustrated, shows the action within the flocsettler of the mixing and blending, flocculation and softening, slurry recirculation, slurry blanket and the settling and sludge concentration operations.

Different designs of this unit for either square, circular or rectangular tanks are shown along with useful data regarding the water analysis report, hypothetical combinations, reactions of chemicals, computation of chemical requirements and conversion factors.

1115
WORK CAPACITY OF TRENCHLINER

Koehring Co., Milwaukee, Wis., has just made available an attractive 12 page catalog describing the **Parsons Model 310 Trenchliner** and illustrates its extra large work capacity features. Printed in two colors and containing more than 50 photographs, this new catalog describes the exclusive, engineering details incorporated in the Trenchliner. Included are such features as: the shiftable digging boom that provides off-set digging for close quarter operation; the power shift conveyor that moves completely through the machine in less than one minute for controlled discharge; the automatic safety clutch to protect machinery from shock loads; unit constructed main frame and oscillating three-point suspension for even weight distribution and uniform ground pressure.

The catalog also points out how this Parsons Trenchliner, equipped with a range of 45 digging feeds, will operate with the utmost efficiency under any working condition.

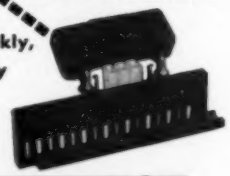
1116
ALUMINUM APPLICATIONS FOR WATER & SEWAGE

Aluminum Co. of America, New Kensington, Pa., has made available two memoranda on the use of aluminum in the water and sewage fields. They are entitled **Wash Water Troughs for Sand Filters** and **Aluminum Applications in Sewage Treatment Plants.** The memorandum on wash water troughs explains how aluminum troughs are hydraulically efficient, easy to install, maintenance free and long lasting. Construction blueprints are also included in this memorandum setting forth various suggestions for construction of the troughs.

The memorandum on use of aluminum in the sewage treatment plants shows that it is used for slide

on the spot **CHLORINE DETERMINATIONS**

made quickly, accurately with a



TAYLOR-ENSLOW SLIDE CHLORIMETER

The ideal instrument for determining the free or residual chlorine content of water, sewage or industrial wastes.

Taylor-Enslow slides are molded of durable plastic and contain a complete set of 9 sealed color standards. Two slides are available: 0.0 to 1.0 p.p.m. and 0.0 to 3.0 p.p.m. of chlorine. All Taylor liquid color standards carry an unlimited guarantee against fading. Combination pH and Chlorine sets, and complete Taylor Water Analyser sets are also available. All sets are easily portable.

READ THIS INFORMATIVE BOOK

Write direct for "Modern pH and Chlorine Control" . . . gives valuable data for all water and sewage operators . . . describes Taylor outfits. See your dealer for equipment.

W. A. TAYLOR AND CO.
7308 YORK RD • BALTIMORE 4, MD.

M-SCOPE Pipe Finder

LIGHTWEIGHT MODEL

One Man Operation
On Every Application

HIGHLY EFFICIENT

IMMEDIATE SHIPMENT

Catalog No. 25M On Request

Free Demonstration and Operating Instructions

JOSEPH G. POLLARD CO., INC.
Pipe Line Equipment
New Hyde Park New York

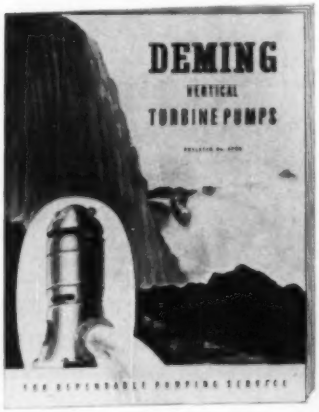
If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

gates and guides, weirs, scum and grease collectors, bar screens etc. Type and recommended alloy to be used for these applications is also given as is a chart showing typical mechanical properties of the recommended aluminum alloys.

1117

DEEP WELL TURBINE PUMPS

The Deming Co., Salem, Ohio has issued a bulletin on **Deming Vertical Turbine Pumps.** This 20-page booklet has large illustrations showing



construction details, various types of drive and typical installations of deep well turbine pumps manufactured by the Deming Co. Graphic portrayal of details is obtained by the use of color printing in construction views. Capacities vary from 12 to 3000 gallons per minute. Within this range almost any combination of capacity, head and speed can be obtained. The bulletin amply describes all of these pumps and their various features and applications.

1118

JOINTING MATERIALS

Atlas Mineral Products Co., Mertztown, Pa., has published a booklet on **Atlas Jointing Materials for Sewer and Water Pipe.** The booklet is made up of a series of bulletins and specification sheets covering descriptions, directions and photographs of installations using these jointing materials. The products and materials covered are: Tegul-Mineralead, Hyde-Ro Ring and Jointing Bell & Spigot cast iron water pipe. For products used in the sewage field there is G-K Sewer Joint Compound, Quantities G-K for Concrete Pipe, Slipjoint G-K Compound, Tegul-Ampco Sewer Compound, Atlastic 77 Sewer Joint Compound, Atlas Accessories and then a general catalog on Materials of Chemical Construction complete this booklet.

1119

WORM GEAR SPEED REDUCERS

DeLaval Steam Turbine Co., Trenton 2, N.J. has issued a new bulletin on **Worm Gear Speed Reducers.** This bulletin covers all the latest revised horse-power ratings and describes how the IMO-DeLaval worm gears are manufactured. The bulletin also lists types of speed reducers, selection tables, horse-power ratings, overhung load tables, dimension tables and other information.

1120

AUTOMATIC PUMP CONTROL

Builders-Providence, Inc., Providence, R.I., has just released a new bulletin on "Pressureflo Control," a system for automatic pump control. This four page bulletin shows the equipment and gives diagrams of typical installations as well as describing the versatility of "Pressureflo Control" and several examples of its application.

One section of the bulletin is devoted to an outline of what this system will provide in automatic pump control. Among the advantages listed are: Savings in first costs by use of

. . . for DOUBLE SAVINGS

The FORD COPPERHORN

The Ford Copperhorn for vertical lines provides TWO important savings . . . . first in original settings and then, later, whenever changes or replacements are necessary.

At the time of the initial setting, only two pipe fittings are required, one above and one below. These fittings are not disturbed when meters are changed . . . . all that is necessary is a few quick turns of the meter coupling nuts and the job is done.

WRITE FOR CATALOG

Write today for full information and the complete Ford catalog No. 50—FREE.

THE FORD METER BOX COMPANY, INC.

FOR BETTER WATER SERVICES

FORD

Wabash, Indiana

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

LEADITE
The Pioneer Self Caulking Material for C. I. Pipe
Thousands of miles are—

Jointed with LEADITE for Satisfaction and Long Life
because Leadite makes a good, tight joint that improves with age . . . and in addition, saves on installation costs.
Write for Literature.
THE LEADITE COMPANY
Girard Trust Co. Bldg., Philadelphia 2, Pa.
No Caulking

ground level storage in residential districts; savings in operating costs by providing unattended operation at outlying stations; elimination of unreliable external control circuits; and instantaneous response to meet fire flow or other unusual conditions with greater efficiency under all conditions.

Another section of the bulletin provides a description of the "Pressure-flo Control" unit and its operation and tells how the device was developed from the pressure-flow control system invented by Marsden C. Smith, Chief, Engr., Dept. of Public Utilities, Richmond, Va.

1121
IMPROVED TRENCHLINER

Parsons Co., Newton, Iowa, has announced the publication of a new catalog describing recent improvements made on the **Parsons Model 221 Trenchliner.** Attractively printed and illustrated, the new 12 page catalog shows in detail some of the exclusive Trenchliner features that provide greater production speeds and more versatile operation.

Some of the exclusive features explained in the new catalog are: arch type frame for maximum strength, travel clearance and digging balance; offset boom that shifts by power for trenching within 1½ inches of crawler tread clearance on either side; arch type discharge conveyor that shifts through entire machine in less than one minute for positive controlled discharge.

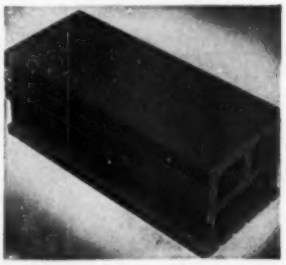
1122
SHORT COUPLED SERVICE PUMPS

Layne & Bowler, Inc., Memphis, Tenn., has just issued a new 16 page bulletin on **Layne Short Coupled Service Pumps.** This new 16 page, 3 color bulletin is profusely illustrated with photographs showing actual installations and cut-away drawings of the various pump bowls and discharge columns.

Sixteen sketches show the Layne Vertical Turbine Pump applied to river and re-lift service, boosting, recirculation, cooling tower, drainage, gas and oil pumping, and fire pumps. Lay-out diagrams are included showing typical methods of installation of the different pumps.

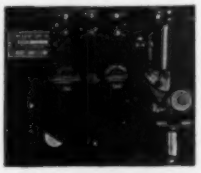
1123
CHEMICAL FEEDERS

Omega Machine Co., Providence 1, R.I., has recently issued a new bulletin on Omega Universal Feeders. This 12-page bulletin is devoted to three sizes covering a chemical feed-

Leopold
GLAZED FIRE CLAY TILE FILTER BOTTOM

• Permanent • Non-corrosive • Economical • Impervious to acid or alkali solutions • Practically non-absorbent • Equal distribution.
Complete water purification and sewage plant equipment.
Write today for complete information
F. B. LEOPOLD CO., INC.
2413 W. CARSON ST. PITTSBURGH 4, PA.

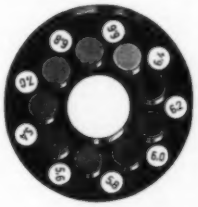
KEEP
PUMPS PRIMED
FOR INSTANT USE

No. 2V—APCO PRIMER
WITH V-APCO AUTOMATIC PRIMER
OR
APCO TANK PRIMERS
AIR RELEASE VALVES
AIR & VACUUM VALVES
VALVE & PRIMER CORP.
127 N. DEARBORN ST.
CHICAGO 2, ILL.

ROTO-TROL

TYPE "A"
Type "A" Roto-Trol operates from the pressure in the pump discharge line, at the pump house. The electric time delay prevents starting or stopping due to surges. It also protects deep well turbines from damage due to back-spin. . . . *Type "A" Multi-Pump Roto-Trol* is designed for two or more pumps discharging into the same discharge pipe. Adjusted time delays compensate for additional pumping friction and surges when second pump starts or stops.
WRITE FOR PERFORMANCE AND ENGINEERING DATA
Water Levels Control Division
HEALY-RUFF COMPANY
783 HAMPDEN AVE., ST. PAUL 4, MINN.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

FOR PRECISE pH Control and WATER TESTS



HELLIGE NON-FADING GLASS COLOR STANDARDS ARE AVAILABLE FOR

HYDROGEN ION MEASUREMENTS pH 0.2—13.6

AMMONIA NITROGEN
BROMINE
CHLORINE
CHROMATE
CHROMIUM
COLOR OF WATER
DISSOLVED OXYGEN
FLUORIDE
IRON
LEAD
MANGANESE
NITRATE NITROGEN
NITRITE NITROGEN
PHOSPHATE
POLYPHOSPHATES
SILICA
SULPHIDES
TANNIN

Hellige Glass Color Standards are safely mounted in unbreakable plastic frames. They are more convenient and economical. They never fade or change. THEY NEVER FAIL.

Pocket Comparator No. 605

WRITE FOR NEW CATALOG NO. 602

HELLIGE
INCORPORATED
3718 NORTHERN BLVD. LONG ISLAND CITY 1, N.Y.
HEADQUARTERS FOR COLORIMETRIC APPARATUS

ing range from 1 to 5000 lb. per hr. These Universal Feeders are designed to handle practically all types of dry chemicals or materials used in the treatment of water and in many process industries.

The bulletin includes a discussion of features such as high accuracy, extremely wide range, dust proof operation and many others. Diagrams show how automatic proportional control may be obtained. Typical arrangements and installations are also given. Photographs of actual equipment are included in the bulletin as are special applications and data on computing dissolving chamber capacities for Universal Feeders. Typical specifications, feeder quotation request sheet, and diagrams and tables of dimensions complete the bulletin.

1124

COMPRESSION FITTINGS

Dresser Manufacturing Division of Dresser Industries, Inc., Bradford, Pa., has announced a new 12 page catalog on **Compression Fittings** for Copper Tubing and Steel Pipe." These fittings employ the same principle as Dresser Couplings which have been used in the gas and water industry. The catalog features a two-page spread which illustrates the twelve specific applications where Dresser fittings give unique performance.

1125

MAIN STERILIZATION

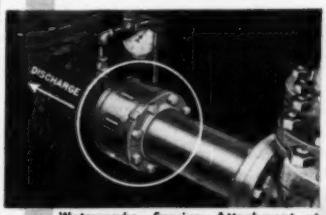
% Proportioneers, Inc.%, Providence 1, R.I., has issued a bulletin on **Main and Emergency Sterilization.** This is one of Proportioneers' series of "standard methods." This "standard method" contains a simple procedure for positive sterilization with simplified calculations. This particular bulletin is a reprint of an article that appeared in *Water & Sewage Works* in May 1950 and contains the directions for preliminary flushing, chlorine dosage contact period, and method of calculations. Also presented is a Water Main Sterilization Chart, as well as the equipment necessary to carry on the main sterilization.

1126

ELECTRONIC TIMER

General Electric Co., Schenectady, N.Y., has released a new folder on the new **Electronic Timer.** This folder describes the versatility, easier mounting, wiring and servicing of the new timer. Drawings and photographs show how it operates and circuit diagrams cover various types of installations.

WILLIAMS-HAGER
flanged Silent check VALVES



Waterworks. Service: Attachment at small end of 6" by 10" increaser.

Vertical and angular positioned valves protect high pressure pumps at the Longview Fibre Company.

Williams Valves serve the Hot Strip Mill descaling systems in a large Eastern Steel Mill.

on duty EVERYWHERE

Dependable protection against water hammer in any position . . . silent operation . . . renewable disc and seat . . . built of materials to suit your installation's needs, in standard pipe sizes from 1" to 20". *Write for Bulletin WH 100.*

THE WILLIAMS GAUGE CO.
Pump Valves . . . Water Gauges . . . Gauge Cocks . . . Steam Traps . . . Pump Governors . . . Feed Water Regulators . . . Water Columns
2000 PENNSYLVANIA AVE. • PITTSBURGH (33), PA.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

1127

UNIONS & VALVES

Catawissa Valve & Fittings Co. has just released a new catalog on **Catawissa Unions & Valves.** This attractive two color catalog illustrates the complete line of hot forged steel unions, as well as the orifice, male and female, lug nut, and full stainless steel and full alloy steel unions are also shown. The catalog also pictures the single and double full opening swing check valves and provides charts on test data and dimensions and weights of steel pipe.

1128

RECORDING GAUGE

The Bristol Co., Waterbury, Conn., has published a 32 page bulletin on its **"Series 500"** line of recording gauges. Complete information is given on pressure gauges for ranges from 0 to 2 inches of water to 0 to 10,000 pounds psi., vacuum gauges, low range draft and pressure gauges, barometers, and absolute pressure gauges for ranges as low as 0 to 6 millimeters of mercury absolute. Measuring elements, operating principles, recording charts and accessories for the various types of recording gauges are fully described. Information is also included on Bristol instruments for automatic controlling and telemetering of pressure and vacuum valves. In addition to numerous photographs, the bulletin is liberally illustrated with reproductions of actual chart records and sketches of applications of the instruments.

Easy to lay MECHANICAL JOINT

M & H VALVE AND FITTINGS COMPANY
ANNISTON, ALABAMA

Our Mechanical Joint Valves, made to AWWA specifications, are furnished in sizes 2" to 30", and valves approved by Underwriters and Associated Factory Mutuals are furnished in sizes up to 12". Iron body, bronze mounted, double disc, parallel seat, hydrostatically tested at 350 lbs. for water working pressures of 175 or 200 pounds. Post Indicator Valves with Mechanical Joint feature are available for use with indicator posts when valves are installed on underground pipe line to serve sprinkler system requiring Underwriters and Associated Factory Mutual's acceptance.

Mechanical Joint features are: Ease and speed of installation, construction economy, joint deflection, leak-tight, long life. Used with AWWA Class A, B, C, D; Federal Spec. WW-P-421; or Class 100, 150, 200, 250 centrifugal pipe.

Figure No. 82M

WRITE FOR CIRCULAR NO. 49

Our new Circular 49 gives important information and installation dimensions of M & H AWWA Mechanical Joint Valves and Hydrants . . . . . Underwriters and Factory Mutual approved Post Indicator Valves . . . . . and Cutting-In Sleeves.

M & H Products · Everywhere

1129

SELF-PRIMING PUMPS

Rice Pump & Machine Co., Milwaukee, Wis., announce that new catalog bulletins including the **Rice 3 inch-15M Self-priming Centrifugal Pump,** as well as the 7M and 10M sizes are available. The bulletins discuss the improvements of the pumps such as: bellow type shaft seals entirely enclosed within a cartridge; hardened steel wearing plates, built-in check valve, large clean-out openings, trash type impellers, and direct line flow of water through the suction opening to the impeller. Specification charts and cross sectional drawings are also included.

1130

SERVICE PUMPS

Layne & Bowler, Inc., Memphis, Tenn., has just issued a 16 page bulletin titled **"Layne Short Coupled Service Pumps".** The bulletin contains cut-away drawings of pump bowls and discharge columns. Sixteen sketches show the Layne Vertical Turbine Pump applied to river and re-lift service, boosting, recirculation, cooling tower, drainage, gas and oil pumping, and fire pumps.

1131

PLASTIC PIPE

Carter Products Corp., Cleveland, Ohio has issued a four page bulletin on **Carlon Plastic Pipe.** This bulletin describes the various types of Carlon pipe and tubing, as well as the well casing. The Carlon pipe is lightweight, corrosion-proof and durable according to the bulletin which gives tables of data on the various types of pipe and tubing.

1132

PRESSURE PUMP CONTROLS

Automatic Control Co., St. Paul, Minn., has just published a new 4 page bulletin on their Autocon Mototrols. The company's attractive 2 color bulletin describes how twin bellows are used in these controls, the ease of adjusting the control to pinpoint accuracy and the

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

sensitivity and flexibility of the control. The bulletin also explains how protection is provided in case of surges, backspin, power failure or dry bearings. A diagram on the back page shows the complete sequence of operation, starting with the tank half full on through until tank has reached low point and has been refilled.

1133

CHEMICAL CONSTRUCTION MATERIALS

Atlas Mineral Products Co., Mertztown, Pa., has announced the publication of a new general bulletin covering their complete line of **Chemical Construction Materials.** The bulletin includes information on: corrosion-proof linings, corrosion-proof cements, acid-proof brick and tile, corrosion-proof brick sheathings, corrosion-proof protective coatings and corrosion-proof floors. It also contains handy estimating data.

1134

STEAM JET SYPHONS

Schutte and Koerting Co., Philadelphia, Pa., has recently issued a new Bulletin on their full line of **SK Steam Jet Syphons** which operate on the jet principle utilizing the energy of steam under pressure to pump, heat, mix liquids and handle solids.

Section 1 of this 24 page catalog details the design, application, construction and operation of the various types of syphons available. Text material is supplemented by photographs and color drawings showing the operation and working parts of the syphons. For complete information, sizes, dimensions, prices and capacities of each type are included in tabular form.

Special purpose and corrosion resistant syphons are covered in Section 2 of the catalog.

Typical applications of steam jet syphons in the pumping, heating and mixing of liquids and the handling of solids are included in Section 3, of special interest to plant and process engineers. Detailed color drawings accompany the descriptive material.

1135

SLUSH-PUMP SUMPS

Barrett, Haentjens & Co., Hazelton, Pa., has just published a bulletin on **Sumps for "Hazelton" Type V-S and V-D Slush-Pumps.** This bulletin gives exact dimensions for the building of the sumps and discusses operating conditions, capacity range, control by float switch,

"GUNITE" DOMES FOR EXISTING RESERVOIRS

This photo shows one of the two "GUNITE" dome roofs built by us at Mattoon, Ill., in 1946 on tanks approximately 90' in diameter. The heavy "GUNITE" ring girders of the domes are reinforced with pre-stressed hoop rods. Similar domes have been constructed, by us, on existing brick reservoirs. "GUNITE" reinforcing was placed on the interior of the reservoirs and, when necessary, on the exposed surface above the ground to stop leakage and further deterioration.

We have built tanks of all "GUNITE" construction with capacities from 25,000 to 2 million gallons. Because of the imperviousness of "GUNITE" tanks, assured by our method of pre-stressing, they can be placed completely underground, on the surface or elevated with equal success. They are in use for storage of water, oil, chemicals and dry materials.

Write today, on your letterhead, for a free copy of Bulletin C2400 which is illustrated with many examples of "GUNITE" for building and repairing tanks, bridges, buildings and other structures.

CEMENT GUN COMPANY
"GUNITE" CONTRACTORS
GENERAL OFFICES—ALLENTOWN, PENNA. U.S.A.
MANUFACTURERS OF THE CEMENT GUN

DEAN GATE OPERATORS

MOTOR TRUCK MOUNTING
FOR GATES TO 60 IN.
★ ★ ★ ★
PORTABLE FOUR WHEEL TYPE
GATES UP TO 48 IN.
★ ★ ★
FOR SMALL GATES IT'S THE POWERENCH
GAS ENGINE DRIVE
PORTABLE, WEIGHS 37 LBS.
PAYNE DEAN & CO. MADISON, CONN.

36 WORDS ABOUT SEWAGE TREATMENT 36

The Bio-Chemical Process (a Guggenheim development) is a proved, economical, complete treatment of sewage—lowest first cost—lowest operating costs, utilizing community trade wastes to treat sewage.

Investigate this process without cost or obligation.

(If you counted only 36 words, you probably didn't realize that "economical" and "proved" are doubly important in connection with the Bio-Chemical Process)

THE BIO-CHEMICAL PROCESS

OFFICES AND LABORATORIES:
2266 N. Meridian, Indianapolis 8, Ind. • 120 Broadway, New York 5, N. Y.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

HYDRO-TITE

•One-fifth the cost of lead

•Available in powder or ingots

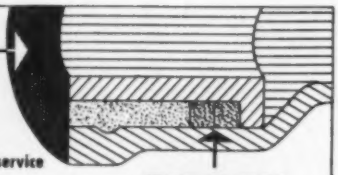
•Over 35 years of dependable service

BEST FOR BELL AND SPIGOT JOINTS

HYDRAULIC DEVELOPMENT CORP.

MAIN SALES OFFICE 50 CHURCH ST., N. Y. C.

General offices and works W. Medford Sta., Boston, Mass.



FIBREX

One-half the cost of braided jute • Easier to use • Will not breed bacteria

double sumps, special sumps and stream pollution. Charts are provided to show pump sizes, capacity-ranges, and sump capacities.

1136
SLUDGE CONTACT REACTORS

Cochrane Corp., Philadelphia, Pa., has just published a booklet on **Sludge Contact Reactors.** This attractive 2-color booklet describes how the chemical principle, that, previously formed precipitated added, in the form of sludge or slurry, to serve as a solids-phase contact agent, will accelerate chemical reactions in general, has been adapted for use by water conditioning plants. Amply illustrated with line drawings and photographs of actual installations the booklet explains how this new unit operates in both round and the rectangular types. Applications of the reactors and auxiliary equipment are also presented.

SPECIFY **Simpson** for accurate Dependable electrical Measurements!

Let Simpson engineers help you solve your panel instrument problems—and for your standard instrument requirements take advantage of our large stock.

FREE

SIMPSON ELECTRIC COMPANY
5200 W. Kinzie, Chicago 44 • CO 1-1221
Please send me Simpson Catalog No. 16 showing complete line of Simpson Electrical Instruments and Test Equipment

Name_____

Company_____

Address_____

_____ Dept. E-5

1137
FOSTER FLOW TUBE

Foster Engineering Co., Union, N. J., has issued a bulletin on the Foster Flow Tube. The bulletin describes the tube, which was formerly known as the Gentile Flow Tube and later as the Bethlehem Flo-Tube. This four page bulletin describes the tube construction, discusses its use, application, and installation, and shows curves for its ratings for different velocities, and materials. It is recommended for high main line velocities, for steam and condensable vapors, and for medium to low main line velocities.

1138
PRESTRESSED CONCRETE PIPE

Price Brothers Co., Dayton, Ohio, has issued a bulletin on **Prestressed Concrete Steel-Cylinder Pipe.** The bulletin describes the construction of this pipe and shows by pictures the steps that are taken to produce the pipe. Also shown are the various tensions and pressures existing in the pipe both empty and under water pressure. A diagram shows the flexible water-tight joint.

1139
STUD WELDING

Nelson Stud Welding Division, Morton Gregory Corp., Lorain, Ohio, has just made available a 16 page illustrated booklet, reprinting the chapter on "Stud Welding" from the third edition of the Welding Handbook.

This booklet explains the stud welding method of fastening various surfaces together, the principal of operation, it describes the equipment and its principal uses, and gives stud locating procedures and other pertinent data.

1140
PHOTOELECTRIC COLORIMETER

Photovolt Corp., New York City, has announced a new bulletin on **LUMERTRON Photoelectric Colorimeter** Model 401. This bulletin describes the photoelectric colorimeter, gives its application, and describes ease of operation and many of its attractive features for the determination of pH or colors and liquids.

1141
SPEED REDUCERS

Falk Corp., Milwaukee, Wis., has just made available a new engineering bulletin on **Speed Reducers, Concentric Shaft.** This 16 page bulletin shows, by means of photographs and drawings, the operation of a reducer, methods of installation and the attachment of various drives. Also included are tables covering horsepower ratings and torque capacity. Minimum sprocket diameters, maximum overhung loads, weights, dimensions, oil capacities and order guide complete the bulletin.

1142
HIGH PRESSURE CLEANERS

Malsbary Manufacturing Co., Oakland, Calif., has made available a 16 page catalog on their **High Pressure Combination Cleaners.** This three color catalog discusses the combination features of having in one unit, high-pressure "steam" cleaning, high-pressure cold water, high-pressure hot water, straight steam and

For Sale

20" Class 100 transite pipe, twelve 13 ft. pieces and miscellaneous lengths complete with couplings and gaskets.

4 20" AWWA Class D cast iron 1/8 bends H & H.

PURCHASING DEPARTMENT

J. F. PRITCHARD & CO.

908 Grand Ave., Kansas City, Mo.

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

JEFFREY—
SPECIALISTS
IN SANITATION

Many successful installations . . . plants serving from 2500 to several million population . . . bear evidence of the carefully-designed units (patented) in the Jeffrey line for water and sewage treatment. Our engineers are specialists . . . will offer technical data on both equipment and design.

Bar screens
Chemical feeders
Flectrols (R) controlled flocculation
Grit collectors
Grit washers
Sludge elevators
Scum removers
Sludge collectors
Screenings grinders
Also equipment for biofiltration plants

Efficient performance with Jeffrey's modern methods

The Jeffrey Mfg. Co.

996 N. 4th Street, Columbus 16, Ohio

Baltimore, Birmingham, Boston, Buffalo, Chicago, Cincinnati, Cleveland, Denver, Detroit, Harlan, Houston, Huntington, Jacksonville, Milwaukee, New York, Philadelphia, Pittsburgh, St. Louis, Salt Lake City, Scranton

Detectron 505
PIPE DETECTORS

FIRST WITH A METAL CASE
FIRST WITH SHIELDED LOOPS
FIRST WITH "SURE GRIP" HANDLE
FIRST WITH LIFETIME GUARANTEE

The new DETECTRON Model 505 locates, traces and centers pipes and cables with speed and accuracy. Small, compact, lightweight—with HEAVY DUTY PERFORMANCE.

- **HIGHER QUALITY**
- **LONGER LIFE**
- **LOWER PRICE**

TRIPLE VALUE!

For Complete Information Write for Folder 11-N

THE Detectron CO.
5637 CAHUENGA BLVD. NORTH HOLLYWOOD, CALIF.

low-pressure hot water. Amply illustrated with photographs of the equipment and actual applications, line drawings with dimensions and cut-away sectional drawings, the catalog explains in detail the operations of the different size units. Included along with the catalog is a large blueprint showing a typical 7 million gallon sewage treatment plant with flow diagram and steam cleaning unit with suggested cleaning station location noted.

1143

IRON REMOVAL

General Filter Co., Ames, Iowa, has made available a bulletin on the **Removal of Iron from Well Waters.** This bulletin describes the operation of the system, the type of plant to use, the design of the equipment and the simplicity of operation. Profusely illustrated with photographs of actual installations the bulletin also shows by means of a cut-away diagram the operation of the main filter unit.

1144

MONOBLOC CENTRIFUGAL PUMPS

Worthington Pump & Machinery Corp., Harrison, N.J., has just published a new bulletin describing **MONOBLOC Centrifugal Pumps** in several models, single and 2 stage, and sizes 1 to 5.

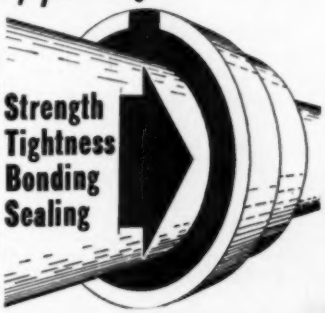
The bulletin includes specifications, motor data and materials for construction. Eleven pages are devoted to a section entitled, "How to Select a Cold Water Pump," which contains rating curves for 50 and 60 cycle speeds at 1,500, 1,800, 3,000 and 3,600 rpm.

1145

PNEUMATIC CONVEYING SYSTEMS

Convair Corp., Pittsburgh, Pa., has just released a bulletin on their **Pneumatic Conveying Systems.** This bulletin explains how the Convair system operates and lists many of the different materials ranging from 800 mesh to lumps up to 8 in. in size and up to 350 lb. per cubic foot in weight. Amply illustrated with line drawings, the bulletin shows how the system operates, handling different materials and how they are distributed throughout the building or storage spaces. According to the bulletin Convair equipment is able to receive two or more materials at the same time or independently and will deliver a perfectly blended product to storage bins.

BOND-O Homogenized



UNIFORMITY
brings you
the perfect
jointing compound

Every ounce, every pound, every bag of BOND-O is identical in structure. Every cast iron pipe joint made with BOND-O —if made the same way—will perform in the same way. In short—if made with reasonable care—every BOND-O joint will be a perfect joint.

To the Water Works Engineer, the use of machine blended BOND-O means uniformity in strength — in tightness — in bonding — in initial seepage — in sealing. It means economy through the elimination of faulty joints . . . economy in man hours — and in money. It means that once a BOND-O joint is made, not another cent need be spent on it for maintenance. ***Proof of this is the fact that there has never been a single reported failure of a BOND-O joint!***

BOND-O

NORTHROP & COMPANY, INC.
SPRING VALLEY NEW YORK

If interested in equipment or literature mentioned above, mail a Reader Service Card with your name, address, and item key number.

Consulting Engineers

SPECIALIZING IN THE FIELD OF

WATER & SEWAGE WORKS

ALBRIGHT & FRIEL, INC.
Consulting Engineers
Water, Sewage and Industrial Waste Problems — Airfields, Refuse Incinerators, Power Plants — Industrial Buildings City Planning—Reports—Valuations
Laboratory
121 South Broad Street, Philadelphia 2, Pa.

BLACK & VEATCH
Consulting Engineers
Water — Sewage — Electricity Industry
Reports, Design, Supervision of Construction, Investigations, Valuation and Rates
4706 Broadway, Kansas City 2, Missouri

CAPITOL ENGINEERING CORPORATION
Engineers—Constructors—Management
SEWAGE SYSTEMS — Designs and Surveys, Planning, Bridges
WATER WORKS — Roads and Streets, Airports, Dams
Executive Offices
DILLSBURG, PENNSYLVANIA

Alvord, Burdick & Howson
Engineers
Charles B. Burdick
Louis R. Howson
Donald H. Maxwell
Water Works, Water Purification, Flood Relief, Sewerage, Sewage Disposal, Drainage, Appraisals, Power Generation
Civic Opera Building — Chicago

Clinton L. Bogert Associates
CONSULTING ENGINEERS
Clinton L. Bogert — Ivan L. Bogert
J. M. M. Greig — Robert A. Lincoln
Donald M. Ditmars — Arthur P. Ackerman
Water & Sewage Works
Refuse Disposal — Industrial Wastes
Drainage — Flood Control
630 Madison Avenue, New York 22, N.Y.

The Chester Engineers
Water Supply and Purification, Sewerage and Sewage Treatment, Power Development and Applications, Investigations and Reports, Valuations and Rates.
210 E. Park Way at Sandusky, Pittsburgh 12, Pa.

ARGRAVES & MORT
ENGINEERS
Sewerage and Sewage Treatment
Refuse Disposal—Industrial Wastes
Water Supply and Purification—Dams
70 COLLEGE ST. — NEW HAVEN, CONN.

Bowe, Albertson & Associates
Engineers
Water and Sewage Works
Industrial Wastes—Refuse Disposal—Municipal Projects
Airfields—Industrial Buildings
Reports—Designs—Estimates
Valuations—Laboratory Service
110 William St. — New York 7, N.Y.

CONSOER, TOWNSEND & ASSOCIATES
Water Supply—Sewerage—Flood Control & Drainage — Bridges — Express Highways — Paving—Power Plants—Appraisals—Reports —Traffic Studies—Airports
351 East Ohio Street, Chicago 11, Ill.

JOHN J. BAFFA
Consulting Engineer
Water Supply and Treatment
Sewerage and Sewage Treatment
75 West Street — New York 6, N. Y.

Buck, Seifert and Jost
Consulting Engineers
(Formerly Nicholas S. Hill Associates)
Water Supply, Sewage Disposal, Hydraulic Developments, Reports, Investigations, Valuations, Rates, Design Construction Operation Management, Chemical and Biological Laboratories
112 East 19th St. — New York

DE LEUW, CATHER & COMPANY
Water Supply — Sewerage
Railroads — Highways
Grade Separations—Bridges—Subways
Local Transportation
Investigations — Reports — Appraisals
Plans and Supervision of Construction
150 North Wacker Drive — Chicago
79 McAllister Street — San Francisco 2, Calif.

Michael Baker, Jr.
The Baker Engineers
CIVIL ENGINEERS AND PLANNERS
MUNICIPAL ENGINEERS
Airport Design—Sewage Disposal Systems
Water Works Design and Operation
Consulting Services — Surveys and Maps
HOME OFFICE—ROCHESTER, PA.

BURGESS & NIPLE
Civil and Sanitary Engineers
Water Supply and Purification
Sewerage and Sewage Treatment
Appraisals, Reports, Valuations
584 East Broad Street, Columbus 15, Ohio

Eckenfelder Associates, Inc.
Sanitary Chemists
Sewage and Industrial Waste Surveys, Process Research and Development, Water Analysis, Stream Pollution, Investigations, Laboratory Analyses and Reports.
45 N. Broad Street — Ridgewood, N.J.

W. H. & L. D. BETZ
CONSULTING ENGINEERS
INDUSTRIAL WASTE
INDUSTRIAL WATER
ANALYSIS — DESIGN
INVESTIGATIONS — OPERATION
Gillingham & Worth Sts.
Philadelphia 24, Pa.

BURNS & McDONNELL
Consulting and Designing Engineers
Kansas City, Mo. — P.O. Box 7088
Cleveland, Ohio — 1404 E. 9th St.

Fay, Spofford & Thorndike
Engineers
Charles M. Spofford — Ralph W. Horne
John Ayer — William L. Hyland
Elon A. Bowman — Frank L. Lincoln
Carroll A. Farwell — Howard J. Williams
Water Supply and Distribution — Drainage
Sewerage and Sewage Treatment — Airports
Investigations and Reports
Designs — Valuations
Supervision of Construction
Boston — New York

BLACK LABORATORIES, INC.
Consulting Engineers and Chemists
On all Problems of
Water, Sewage, and Waste Treatment
ANALYSIS · TREATMENT CONTROL
RESEARCH
988 South Oak Street
Gainesville, Florida

Camp, Dresser & McKee
Consulting Engineers
6 Beacon Street, Boston 8, Mass.
Water Works and Water Treatment; Sewerage and Sewage Treatment; Municipal and Industrial Wastes; Investigations and Reports; Design and Supervision; Research and Development; Flood Control.

GANNETT FLEMING CORDDRY AND CARPENTER, INC.
ENGINEERS
Pittsburgh, Pa. — Scranton, Pa.
HARRISBURG, PA.
Water Works, Sewage, Industrial Wastes & Garbage Disposal—Roads, Airports, Bridges & Flood Control. Town Planning, Appraisals, Investigations & Reports.

GILBERT ASSOCIATES, INC.
Engineers and Consultants
Water Supply and Purification
Sewage and Industrial Waste Treatment
Chemical Laboratory Service
Investigations and Reports
New York · Reading, Pa. · Washington
Houston · Philadelphia

Jones, Henry & Schoonmaker
(Formerly Jones & Henry)
Consulting Sanitary Engineers
Water Works
Sewerage & Treatment
Waste Disposal
Security Bldg. · Toledo 4, Ohio

Malcolm Pirnie Engineers
Civil & Sanitary Engineers
Malcolm Pirnie · Ernest W. Whitlock
Richard Hazen · G. G. Werner, Jr.
Investigations, Reports, Plans
Supervision of Construction and Operations
Appraisals and Rates
25 West 43rd St., New York 18, N. Y.

Ivan M. Glace
Consulting Sanitary Engineer
WATER SUPPLY AND PURIFICATION
SEWERAGE AND SEWAGE TREATMENT
Design, Construction and
Supervision of Operation
Telephone 6-0407 · 1061 North Front St. Harrisburg, Pa.

ENGINEERING OFFICE OF CLYDE C. KENNEDY
COMPLETE ENGINEERING SERVICE
For More Than a Quarter Century
Investigations, Reports, Design, Supervision of Construction and Operation
Water Supply, Water Conditioning, Sewerage, Sewage and Industrial Waste Treatment
CHEMICAL and BIOLOGICAL LABORATORY
604 Mission Street · San Francisco, 5

The Pitometer Company
Engineers
Water Waste Surveys, Trunk Main Surveys, Water Distribution Studies
Penstock Gaugings
New York, 40 Church St.

WILLIAM A. GOFF, INC.
General Engineering and Consulting Services—Water, Sewerage, Refuse Incineration, Industrial Buildings, Power Plants, Airport, Town Planning Plans, Supervision, Valuations, Reports
1321 Arch Street · Philadelphia 7, Pa.

Morris Knowles, Inc.
Engineers
Water Supply and Purification, Sewerage and Sewage Disposal, Valuations, Laboratory, City Planning
1312 Park Building, Pittsburgh, Pa.

LEE T. PURCELL
Consulting Engineer
Water Supply & Purification; Sewerage & Sewage Disposal; Industrial Wastes; Investigations & Reports; Design; Supervision of Construction & Operation
Analytical Laboratories
1 Lee Place · Paterson 1, N. J.

GREELEY AND HANSEN
Engineers
Samuel A. Greeley · Paul Hansen (1920-1944)
Paul E. Langdon · Kenneth V. Hill
Thomas M. Niles · Samuel M. Clarke
Water Supply, Water Purification
Sewerage, Sewage Treatment
Flood Control, Drainage, Refuse Disposal
220 S. State Street, Chicago 4

WM. S. LOZIER CO.
Sewerage, Sewage Disposal, Water Supply, Water Purification
Refuse Disposal
Consulting Engineers
10 Gibbs Street · Rochester 4, N. Y.

Thomas M. Riddick
Consulting Engineer and Chemist
Municipal and Industrial Water Purification, Sewage Treatment, Plant Supervision, Stream Pollution Investigations, Chemical and Bacteriological Analyses.
369 East 149th Street
New York 55, N. Y.

Havens & Emerson
W. L. Havens · C. A. Emerson
A. A. Burger · F. C. Tolles · F. W. Jones
Consulting Engineers
Water, Sewage, Garbage, Industrial Wastes, Valuations—Laboratories
Leader Building · Cleveland 14 · Woolworth Bldg. · New York 7

Metcalf & Eddy
Engineers
Water, Sewage, Drainage, Refuse and Industrial Waste Problems
Airfields · Valuations
Laboratory
Statler Building · Boston 16 · 111 Sutter St. · San Francisco 4

ROBERT AND COMPANY ASSOCIATES
Architects & Engineers
• ATLANTA •
WATER SUPPLY • INCINERATORS
SEWAGE DISPOSAL • POWER PLANTS

Hayden, Harding & Buchanan
Consulting Engineers
John L. Hayden
John H. Harding · Oscar J. Campia
Waterworks, Sewerage, Civil, Mechanical, Electrical, Structural
828 Park Square Building, Boston, Mass

INDUSTRIAL WASTE CONSULTANTS
(A Guggenheim Subsidiary)
INVESTIGATIONS AND REPORTS
Offices and Laboratories
2266 No. Meridian, Indianapolis 8, Indiana
120 Broadway, New York 5, New York
Russell B. Moore—A. F. Nielsen—Robert J. Theroux
(Memberships in ASCE, AWWA, AIMME, CSSWA, ACS)

Russell & Axon
Consulting Engineers
Geo. S. Russell · F. E. Wenger
Joe Williamson, Jr.
Water Works, Sewerage, Sewage Disposal Power Plants, Appraisals
408 Olive Street · St. Louis 2, Mo. · Municipal Airport · Daytona Beach, Fla.

Charles Haydock
Consulting Engineer
Water Works and Sanitation, Industrial Wastes, Design, Construction, Operation and Management. Reports and Valuations.
2314 Girard Trust Company Building
Broad Street and South Penn Square
Philadelphia 2, Pa.

Nussbaumer, Clarke & Velzy, Inc.
Newell L. Nussbaumer—Irving Clarke—Charles R. Velzy
Water Supply and Treatment
Sewerage & Sewage Disposal
Garbage Incineration
Town Planning
52 Vanderbilt Ave., N. Y. City
327 Franklin St. · Buffalo, N. Y.

J. E. SIRRINE Company
Engineers
Water Supply & Purification
Sewage & Industrial Waste Disposal
Stream Pollution Reports
Utilities, Analyses
Greenville · South Carolina

HITCHCOCK & ESTABROOK, Inc., LESTER D. LEE, Associate
Professional Engineers and Architects
Consultants to Municipalities since 1920
WATER, SEWERAGE, PAVING, POWER PLANTS, AIRPORTS, REPORTS AND APPRAISALS
521 Sexton Bldg.
Minneapolis 15, Minnesota

PARSONS, BRINCKERHOFF, HALL & MACDONALD
G. Gale Dizon, Associate
ENGINEERS
Dams, Water Works, Sewerage, Airports, Bridges, Tunnels, Traffic & Transportation Reports, Highways, Subways, Foundations, Harbor Works, Valuations, Power Developments, Industrial Buildings
51 Broadway, New York 6, N. Y.

Benjamin L. Smith & Associates
Engineers
Investigations — Reports
Designs — Supervision — Valuations
Municipal Engineering and Public Utilities
11 North Pearl Street
Albany 7, New York

(Continued on next page)

CONSULTING ENGINEERS

Specializing in the Field of

WATER AND SEWAGE WORKS

STANLEY ENGINEERING COMPANY
Consulting Engineers
Water Works—Sewerage
Electric Power—Flood Control
Rate Studies—Valuations—Industrial
Airports . . . . . Municipal Buildings
Hershey Bldg., Muscatine, Ia.

Phillip B. Streander & Affiliates
Consulting Engineers
582 Atlantic Avenue, Boston 11, Mass.
Water Supply, Treatment, Distribution
Trade Wastes, Refuse Disposal
Sewerage, Sewage Treatment
Plans, Supervision, Reports

Weston & Sampson
Water Supply, Water Purification, Sewerage, Sewage and Industrial Waste Treatment, Corrosion Control, Laboratory Service
Supervision, Valuations
14 Beacon St. Boston, Mass.

Whitman & Howard
Engineers (Est. 1869)
Water Supply, Water Purification, Sewerage, Sewage Disposal, Water Front Improvements and all Municipal and Industrial Development Problems, Investigations, Reports, Designs, Supervision, Valuations.
89 Broad St., Boston, Mass.

WHITMAN, REQUARDT AND ASSOCIATES
Engineers — Consultants
Civil—Sanitary—Structural—Mechanical—Electrical. Reports, Plans, Supervision. Appraisals
1304 St. Paul Street
Baltimore 2, Maryland

SITUATION WANTED
CHEMIST-FILTER PLANT SUPT. Desires to change location. Has excellent record and exceptional experience. Will consider foreign or domestic position.
Box 1045 Water and Sewage Works
22 West Maple Street
Chicago 10, Illinois

Cast Iron Bell and Spigot Water Pipe
At A Drastic Reduction In Price
10" Class B—14,736 feet
Also
6" Class B —1,635 feet
8" Class 250—4,328 feet
Excellent Used Condition
Immediate Delivery Below Mill Price
WRITE—WIRE—PHONE
SONKEN-GALAMBA CORPORATION
2nd and Riverview (X-638)
Kansas City 18, Kansas THatcher 9243

INDEX TO ADVERTISERS

A

Allis-Chalmers 27A
Aluminum Company of America.... 35A
American Brass Co..... 12A
American Car & Fdry. Co..... 14A
American Concrete Pipe Assn..... 85A
*Anthracite Equipment Co..... 101A
Atlas Mineral Products Co. of Pa., The 84A

B

Bio-Chemical Process, The..... 109A
Blaw-Knox Co..... 93A
Buffalo Meter Co..... 99A
*Builders-Providence, Inc. 15A-102A
Byers Co., A. M..... 9A

C

Carborundum Co., The..... 8A
Carson-Cadillac Corp..... 101A
Cast Iron Pipe Research Ass'n...10A-11A
Cement Gun Co..... 109A
Centriline Corp. 90A
Chicago Bridge & Iron Co..... 13A
*Chicago Pump Company..... 82A
Clow & Sons, Jas. B..... 24A
Crane Co. 21A

D

Darling Valve & Mfg. Co..... 22A
Dearborn Chemical Co..... 23A
Detectron Company, The..... 111A
Directory of Engineers...112A-113A-114A
Dixie Tank & Bridge Co..... 91A
*Dorr Co. .....Third Cover
Dow Chemical Co..... 86A
Dresser Mfg. Division..... 20A

E

Ebony Paint Mfg. Co..... 97A

F

Filer & Stowell..... 100A
Flexible Sewer-Rod Equipment Co... 98A
Flexible Underground Pipe Cleaning Co..... 98A
Foster Engineering Co..... 88A
Ford Meter Box Co..... 105A
Foxboro Co., The..... 103A

G

General Electric Co.....6A-7A
Goldak Company, The..... 93A
*Golden-Anderson Valve Specialty Co..... 18A

H

Hamilton Kent Mfg. Co..... 36A
Haynes Products Co..... 97A
Healy-Ruff Co..... 106A
*Hellige, Inc..... 107A
Hydraulic Development Corp..... 110A

I

Industrial Chemical Sales Co..... 21A
*Infilco, Incorporated..... 17A

J

*Jeffry Mfg. Co..... 111A

K

Keasbey & Mattison Co..... 16A

L

Layne & Bowler..... 21A
Leadite Company..... 106A
Leopold Co., F. B..... 106A
Lock Joint Pipe Co.....Second Cover
Lumenite Electronic Co..... 93A

M

M. & H. Valve Fitting Co..... 108A
Mathieson Chemical Corp..... 4A

N

Neptune Meter Company..... 38A
Nordstrom Valve Div. (Rockwell).. 87A
Northrop & Co., Inc..... 111A

O

Omega Machine Co..... 25A

P

Pacific Flush Tank Company..... 34A
Payne Dean & Co..... 109A
Peerless Pump..... 29A
Phipps & Bird Inc..... 99A
Pilot Mfg. Co..... 93A
*Pittsburgh-Des Moines Steel..... 33A
Pollard Co., Inc., Joseph G..... 104A
Pritchard & Co., J. F..... 110A
Process Engineers, Inc..... 19A
*Proportioneers, Inc..... 96A

R

Roberts Filter Mfg. Co..... 104A
Rockwell Mfg. Co..... 3A
Roots-Connersville Blower Corp.... 95A
Royer Foundry & Mach. Co..... 101A

S

Saran Lined Pipe Co..... 86A
Simpson Electric Company..... 110A
Smith Mfg. Co., A. P..... 30A
Smith, S. Morgan..... 28A
Solvay Sales Div. (Allied Chem. & Dye Corp.) 94A
Sonken-Galamba Corp. 114A
*Sparling Meter Co..... 104A

T

Taylor & Co., W. A..... 104A
Tennessee Corp..... 91A

U

*U. S. Pipe & Fdry Co..... 37A

V

*Valve & Primer Co..... 106A

W

*Wallace & Tiernan Co., Inc...Back Cover
Warren Foundry & Pipe Corp..... 97A
Williams Gauge Co..... 107A
Wood Company, R. D..... 32A

Y

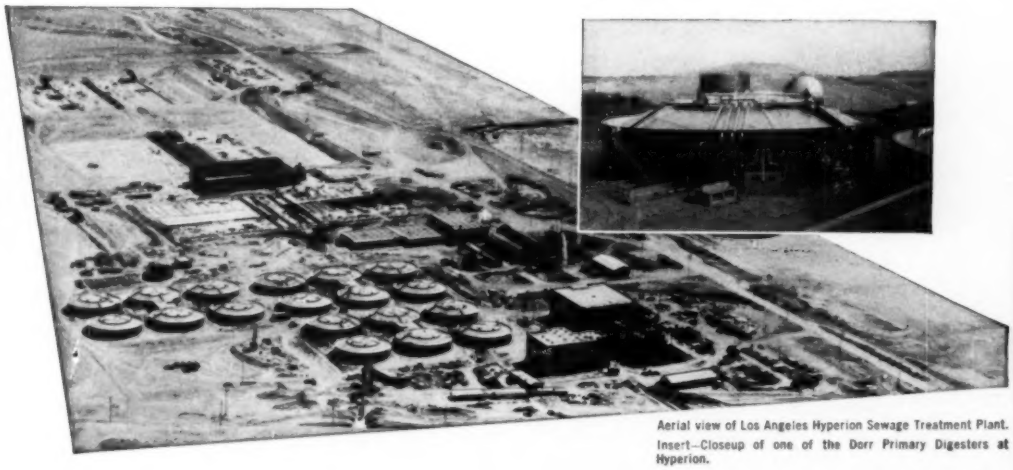
Yeomans Bros..... 92A

Z

Zeolite Chemical Co..... 99A

*Advertisers with * were represented in the May, 1950, Convention and Data Edition with Catalog specifications copy. Please refer to that issue for additional information on behalf of their products.

Interested in BIG SCALE sludge digestion?



Aerial view of Los Angeles Hyperion Sewage Treatment Plant.
Insert—Closeup of one of the Dorr Primary Digesters at Hyperion.

HERE ARE TWO EXAMPLES of recent Dorr Multdigestion installations . . . built for big capacity . . . at a reasonable installed and operating cost:

For the 245 MGD Los Angeles Hyperion Plant

. . . 18 Dorr Digesters, each 110'-11" in diameter have recently been placed in operation. The 12 Primaries are each equipped with three draft tubes and high capacity mixers . . . the six Secondaries provide for quiescent settling.

For the 25 MGD Oklahoma City Southside Plant

. . . two Dorr Multdigestion Systems are nearing completion, each with three Primaries and one Secondary. All eight tanks are 90' in diameter. 100,000 cu. ft. of gas storage is provided. Each Primary is equipped with three high capacity mixers to dissipate scum and speed-up digestion.

Dorr Multdigestion . . . providing thorough mixing of raw and digested sludge . . . is the ideal answer to big scale digestion problems. If you don't already have Bulletin #6261, write for a copy today. It contains 60 pages of detailed information on all types of Dorr Digesters.

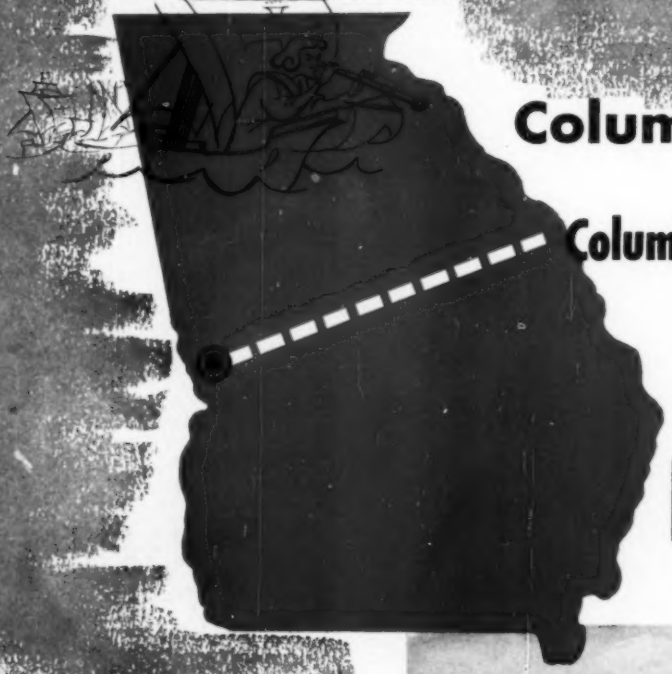
AND BEAR IN MIND . . . for communities where single-stage digestion is applicable, the Dorr Type MA Digester combines the advantages of high-capacity mixing and gas storage in a single unit. Bulletin #6591 describes this modern unit and will be sent on request.

DORRCO

THE DORR COMPANY, ENGINEERS
BARRY PLACE, STAMFORD, CONN.
NEW YORK • ATLANTA • TORONTO
CHICAGO • DENVER • LOS ANGELES
RESEARCH AND TESTING LABORATORIES
WESTPORT, CONN.
SUGAR PROCESSING
PETREE & DORR DIVISION, STAMFORD, CONN.
ASSOCIATES AND REPRESENTATIVES
Dorr Technical Services and Equipment Are Also Available Through Associated Companies and Representatives in the Principal Cities of the World. Names and Addresses on Request.

DORR

RESEARCH [illegible] ENGINEERING [illegible] EQUIPMENT



Columbus--

Columbus, *GEORGIA*, that is-

discovers

BREAK-POINT

Here's what Mr. George Lowe, General Manager of the 18 mgd Columbus, Georgia Water Works has to say about his experiences with Break-Point:

". . . In 1944 when Break-Point was applied at our plant, we promptly received several advantages. We increased filter runs, obtained better coagulation, and eliminated our troubles with slime and algae . . ."

Columbus, Ga. Water Works where chlorination by Wallace & Tiernan is on the job

S-51

Such results are typical with the Break-Point Process and dependable W&T Equipment. In the case of the Columbus Water Works, four W&T Master Chlorinators handle pre- and post-chlorination and ensure an average ***free residual*** of between 0.4 and 0.6 ppm in practically all parts of the distribution system.

W&T Equipment is the first choice of thousands of progressive water works across the country because every unit is precision built with custom care to give long trouble-free service. Such equipment, backed by over 35 years of leadership in chlorination, and coupled with the facilities of a nationwide service staff, insures dependable, proven results.

Find out today how the Break-Point Process —especially when coupled with W&T Residual Chlorine Recorders — can help you. Your nearest W&T Representative will be glad to give you all the necessary information.

WALLACE & TIERNAN
COMPANY, INC.
CHLORINE AND CHEMICAL CONTROL EQUIPMENT
NEWARK 1, NEW JERSEY • REPRESENTED IN PRINCIPAL CITIES